VPDES PERMIT PROGRAM FACT SHEET

This document gives pertinent information concerning the VPDES permit listed below. This permit is being processed as a Minor, industrial permit. The wastewater discharges result from treated storm water discharges associated with industrial activity that result from the operation of a railroad switching yard and locomotive fueling area. The permit process consists of limiting pH, total suspended solids, oil and grease and acute whole effluent toxicity. The permit also includes other requirements and special conditions to ensure compliance with the State Water Quality Standards.

1. Facility Name and Address: SIC Code: 4013

   Norfolk Southern Railway Company
   Weller Yard
   110 Franklin Road, S.E.
   Box 13
   Roanoke, VA 24042

   Location: Route 460, west of Grundy

2. Permit No: VA0052639 Expiration Date: March 24, 2012

3. Owner Contact:

   R.P. Russell, System Director
   Environmental Protection
   Norfolk Southern Railway Company
   1200 Peachtree Street, NE
   Box 13
   Atlanta, GA 30309
   Telephone No.: (404) 582-4239

   Facility Contact:

   Michael East, Engineer
   (michael.east@nscorp.com)
   Environmental Operations
   110 Franklin Road S.E.
   Box 13
   Roanoke, VA 24042

   Telephone No.: (540) 981-4994

4. Application Processing:

Application Complete Date:	October 18, 2011
DEQ Regional Office:	Southwest Regional Office
Permit Drafted By:	Mark S. Trent

______________________ Date: February 10, 2012

Reviewed by: ______________________ Date: ______________

5. Receiving Waters Classifications:

Receiving Stream:	Levisa Fork River
Basin:	Tennessee – Big Sandy River
Subbasin:	Big Sandy River
Section:	3
Class:	IV
Special Standards:	none

6. Licensed Operator Requirements:

No licensed operator will be required.

7. Reliability Class: NA

8. Permit Characterization:

(X) Private
(   ) Federal
(   ) State
(   ) POTW
(   ) Possible Interstate Effect
(   ) Interim Limits in Other Document (attach to Fact Sheet)

9. Facility Location:

The Norfolk Southern Railway Company - Weller Yard facility is located in Buchanan County, near the community of Big Rock, off Route 460 west of Grundy. A location map is included as **Attachment A**.

Name of Topo: Harman, VA 7.5' Quadrangle

Latitude: N 37 19' 42"   Longitude: W 82 10' 28"

10. Facility Description:

The Norfolk Southern Weller Yard is a railroad facility serving the Norfolk Southern Railway Company. The facility is used for minor locomotive servicing and direct-to-locomotive refueling as well as storage and switching of railroad cars. The discharges from the facility result from surface water runoff from the yard, and from the areas surrounding the fueling and servicing areas. A schematic diagram of the site is included as **Attachment B**.

Routine locomotive and rail car servicing at the facility is limited to minor maintenance to the exteriors of the equipment and lubrication of critical components. No heavy mechanical repairs to the engines or other major mechanical components are performed at the facility, and no wastewater sources are created by the servicing operations. Direct to locomotive (DTL) fueling replaced the fixed fueling practices previously used at the facility. The DTL fueling is performed by an independent contractor who dispenses fuel to the locomotives from tanker trucks.

Discharge Description

OUTFALL NUMBER	DISCHARGE SOURCE	TREATMENT	FLOW
001	Storm Water Runoff	Grit Removal Sedimentation Oil Water Separation	0.005 MGD Avg. 0.015 MGS Max.

11. Wastewater Treatment:

The water treatment system was installed to contain fuel spillage and to treat storm water runoff from the fueling and servicing areas. The treatment is designed to remove solids and reduce petroleum contamination from the discharge water. The system consists of two structures: 1) an influent grit chamber, and; 2) a circular oil water separator. Waste oil from the separation process is pumped from the oil water separator and stored in an adjacent 500 gallon tank until it is removed from the site by a waste oil disposal contractor. A process flow diagram of the water treatment system is included as **Attachment C**.

12. Material Storage:

The facility has taken the locomotive fueling system out of service, and currently performs all fueling operations directly from a tanker truck ("direct-to-locomotive" or DTL fueling). Consequently, the diesel fuel tanks which were previously used for fuel storage are no longer used, and have been closed in accordance with petroleum storage tank regulations.

13. Residuals Management:

All solid waste, contaminated oil absorbent booms or pads, or other residuals produced by the wastewater treatment are placed in a covered water tight dumpster-like container until removed from the site by a disposal contractor.

14. Site Inspection:

Date: May 5, 2009 Performed By: D. L. Petty

A complete technical inspection was conducted on May 5, 2009 and no deficiencies were observed. Similarly, a laboratory inspection and sampling inspection were conducted in conjunction with the technical inspection and no deficiencies were observed.

15. NPDES Permit Rating Worksheet:

The staff has completed the NPDES Permit Rating Worksheet and has determined that the facility does not meet the criteria to be classified as a major source. The completed worksheet is on file at the regional office.
Total Score: 20

16. Receiving Waters Information:

The wastewater treatment system at the Weller Yard discharges into the Levisa Fork River, a tributary of the Tug Fork River in the Tennessee-Big Sandy River Basin. The discharge is approximately 5 miles upstream of the Kentucky State Line. (Basin: Tennessee-Big Sandy; Sub-basin: Big Sandy River; Section: 3; Class: IV; Special Standards: None). The drainage area of the Levisa Fork watershed above the discharge point is estimated to be approximately 274 square miles.

The USGS has operated a continuous record gauging station on the Levisa Fork River at Big Rock (03207800). Data from this station were utilized to estimate the low-flow characteristics at the discharge location. The resulting estimates of the flows are listed below:

	Levisa Fork
1Q10 -	5.88 MGD
7Q10 -	7.30 MGD
30Q5 -	13.8 MGD
H.M. -	51.3 MGD

The Levisa Fork River which receives the discharge from this operation is currently contained in the 2010 303(d) list of impaired waters. The impairment to the Levisa Fork River has been attributed to violations of the stream standards for Escherichia coli, Fecal Coliform, polychlorinated biphenyls (PCBs), and for violations of the aquatic life general standard as evidenced by a depressed benthic community.

The Fish Tissue station located at 6AGAR000.16 found polychlorinated biphenyls (PCBs) in the sediment and station 6AGAR001.78 exceeded DEQ's screening value for PCBs. Station 6ALEV130.00 exceeded the Virginia Department of Health's (VDH) human health criteria for PCBs. PCBs were also detected at Fish Tissue station 6ALEV151.26, 6ALEV145.86, 6ALEV134.82, and 6ALEV130.00.

The ambient water quality monitoring (AWQM) station located at 6ALEV156.82 had a 60% exceedance of the E.coli water quality standard, station 6ADIS001.24 had a 13% exceedance of the E.coli water quality standard, station 6ADIS014.33 had a 16% exceedance of the E.coli standard, station 6ABIP000.65 had a 21% exceedance of the bacteria standard, station 6ALEV143.86 had a 13% exceedance of the E.coli water quality standard, station 6ASAT000.26 had a 43% exceedance of the E.coli standard and station 6ALEV131.52 had a 14% exceedance of the E.coli water quality standard.

The AWQM stations located at 6ASAT000.05, 6ASAT004.52, 6ASAT007.71 and6AHME002.16 were impaired based on Virginia Stream Condition Index (VSCI) scores. Station 6ALEV152.46 was impaired based on VSCI scores of 41 and 57 in 2007 and station 6ALEV130.29 was impaired based on VSCI scores of 38 and 54 in 2007.

17. Effluent Screening:

The facility has monitored the discharge in accordance with the Part I requirements in the VPDES permit and with the requirements of application Form 2C and Form 2F. A review of the monitoring results indicates that the facility has performed the required analyses, and has consistently met the effluent limitations for the discharge.

Additionally, the applicant provided results of an analysis for polychlorinated biphenyls using the low level PCB method 1668. Although the analysis results did not detect a presence of PCBs, the minimum levels (quantification level) of the tests were 200 pg/l on a congener basis. The current agency guidelines for PCB reporting of discharges within PCB TMDL segments requires lower quantification levels than the 200 pg/l minimum levels reported.

18. Monitoring Frequency Reduction:

A monitoring frequency reduction to once per quarter was granted during the last permit reissuance. The frequency reduction was based upon consistent compliance with the effluent limitations and other requirements of the permit. The frequency reduction is proposed to be continued during the subsequent permit term. The permit contains a provision which would require the reinstatement of monthly monitoring should the facility be issued a notice of violation for effluent violations.

19. Toxic Management Program:

The VPDES permit for the Weller Yard facility includes an acute Whole Effluent Toxicity (WET) limitation which became effective on April 1, 1997. During the current permit term, the facility has conducted annual acute whole effluent toxicity tests in order to measure their compliance with the WET limit established in Part I.A of the permit. A review of the results of this testing indicates that the facility has consistently achieved compliance with the limit. However, the annual report for the 2011 monitoring year indicated a potential violation of the whole effluent toxicity limit as indicated by a result of 2.8 TUa reported from a single grab sample collected on December 6, 2011. The applicant is currently investigating the potential causes of the violation and is currently developing remedial measure to address the violation as required by the DEQ compliance procedures. The company's plan of action will be submitted to DEQ for review and concurrence in accordance with DEQ compliance procedures.

The staff believes that the proposed frequency is sufficient to measure the facility's compliance with the limit given the consistent quality of the discharge exhibited during the recent history of the discharge. However, should the remedial measures not promptly return the facility to compliance with the limit, the monitoring frequency for whole effluent toxicity will revert to quarterly monitoring in accordance with Part I.B.3 of the permit.

20. Storm Water Discharges Associated with Industrial Activity:

Because the SIC Code for the facility is 4013, the facility is included under the categories of storm water associated with industrial activity as defined by the state and federal regulations (40 CFR 122.26 and 9 VAC 25-31-10) which establish requirements for discharges of storm water runoff. Therefore, storm water management conditions are proposed in the permit. These storm water management requirements are based upon the Department's standard storm water requirements as defined by 9 VAC 25-151-10, and include the sector specific requirement (Sector P – Land Transportation and Warehousing) of 9 VAC 25-151-230 as they apply to rail transportation facilities. The Sector P conditions require benchmark monitoring for Total Suspended Solids (TSS) and Total Petroleum Hydrocarbons (TPH) in addition to any Part I.A effluent limitations which apply to outfall 001.

21. 303(d) Listed Segments and TMDL Development:

The Levisa Fork River which receives the discharge from this operation is currently contained in the 2010 303(d) list of impaired waters. The impairments to the Levisa Fork has been attributed to violations of the stream standards for Escherichia coli, Fecal Coliform, polychlorinated biphenyls (PCBs), and for violations of the aquatic life general standard as evidenced by a depressed benthic community.

The Norfolk Southern Weller Yard facility discharges into a section of the Levisa Fork which has been listed for impairment by tPCBs (VAS-Q08R_LEV02A00). The Department of Environmental Quality has developed a Total Maximum Daily Load (TMDL) report for the watershed, including this segment. On March 18, 2011, the U.S. Environmental Protection Agency approved the TMDL report for (E. *coli*, Phased Benthic, and Phased Total PCB TMDL Development for Levisa Fork, Slate Creek, and Garden Creek).

The TMDL report includes a water quality assessment for total PCBs (Chapter 12), a total PCB Source Assessment (Chapter 13) and tPCB Modeling procedure and Allocation (Chapter 14). Copies of these sections are included in this Fact Sheet as **Attachment D**.

The source assessment in the report cites that the tPCB concentration in the discharges from the Norfolk Southern Weller Yard facility are estimated to be 43,839 picograms per liter (pg/L or 10^{-12} grams) during dry season discharges, and 45,027 pg/L during wet season discharges. This value is an estimation of the potential discharge which is based on 1/2 the Estimated Minimum Level of all 209 PCB congeners. Although the facility had reported data for the discharge, and all tPCB congeners were reported as non-detect; the analysis was reported at an elevated reporting level, and the low-level values could not be accurately deduced.

Table 14.7 of the Report (Page 14-20) identifies the modeled wasteland allocation for the Norfolk Southern Weller Yard discharge to be 0.88 mg/yr. This figure represents the allocation to the Norfolk Southern Weller Yard facility which would meet the PCB endpoint of the 640 pg/l necessary to ensure compliance with the water quality standards.

Because the facility is assigned a numeric waste load allocation (WLA) in the approved TMDL, the facility must provide additional monitoring data in order to document their compliance with the established WLA. Because the discharges are storm water dependant, the permttee shall monitor 2 samples during 2 different events in accordance with the PCB monitoring TMDL Guidance Memo No. 09-2001(March 6, 2009) and TMDL Guidance Memo No. 09-2001 Amendment No.1 (November 1, 2011).

These guidance documents may be found on the DEQ website at:

http://www.deq.virginia.gov/export/sites/default/tmdl/pptpdf/pcb/pcbmonguidance.pdf ;

and;

http://www.deq.virginia.gov/export/sites/default/tmdl/pptpdf/pcb/psguideamend1.pdf .

The tPCB monitoring requirement as listed as Special Conditions in Part 1.B.7 of the proposed permit will require the permittee to monitor the effluent at Outfall 001 for Polychlorinated Biphenyls (PCBs). DEQ will use these data for implementation of a PCB TMDL for the Levisa Fork River. If the results of this monitoring indicate actual or potential exceedance of the the Waste Load Allocation specified in the approved TMDL, the permittee will be required to submit a Pollutant Minimization Plan (PMP) designed to locate and reduce sources of PCBs in the collection system. A component of the plan may include an evaluation of the PCB congener distribution in the initial source intake water to determine the net contributions of PCBs introduced to the treatment works.

22. Anti-degradation Review & Comments:

Tier: 1 _X___ 2_____ 3_____

The State Water Control Board's Water Quality Standards includes an anti-degradation policy (9VAC25-260-30). All state surface waters are provided one of three levels of anti-degradation protection. For Tier 1 or existing use protection, existing uses of the water body and the water quality to protect these uses must be maintained. Tier 2 water bodies have water quality that is better than the water quality standards. Significant lowering of the water quality of Tier 2 waters is not allowed without an evaluation of the economic and social impacts. Tier 3 water bodies are exceptional waters and are so designated by regulatory amendment. The anti-degradation policy prohibits new or expanded discharges into exceptional waters.

The antidegradation review begins with a Tier determination. The Levis Fork is determined to be a Tier 1 waterbody. Since this segment of the watershed has been identified as not meeting the water quality standards, the receiving waters are considered to be impaired waters, and the segment is classified as "Tier 1" waters. Because the permit is meeting the required limitations, which include a whole effluent toxicity limit, the action is considered to comply with the anti-degradation provisions of the regulations.

23. Effluent Limitations:

The proposed effluent limitations and monitoring requirements for the site address the wastewater discharges which result from storm water runoff from the areas served by the treatment system at outfall 001. The existing permit contains effluent limitations for pH, total suspended solids, oil and grease and whole effluent toxicity. The limits for pH, TSS and oil and grease were based upon the Department's recommended effluent limitations as applied to the railroad industry, and have been effective since 1975. The toxicity limit was imposed effective April 1, 1997 to address potential toxicity identified in the initial toxicity screening.

The existing effluent limitations and monitoring requirements for pH, TSS, oil and grease and whole effluent toxicity are proposed to be continued from the previous permit without change. Benchmark monitoring for TPH has been added for outfall 001. The effluent limitations and monitoring requirements for 001 are summarized in the table below:

( ) Interim Limitations Effective Dates: From: issuance
(X) Final Limitations To: expiration

PARAMETER	BASIS FOR LIMIT	DISCHARGE LIMITATIONS				MONITORING REQUIREMENT	
		Monthly Average	Weekly Average	Minimum	Maximum	Frequency	Sample Type
FLOW	NA	NL	NA	NA	NL	1/3Months	Estimate
pH	3	NA	NA	6.0	9.0	1/3Months	Grab
TSS	2	30 mg/l	NA	NA	60 mg/l	1/3Months	Grab
Oil and Grease	2	NA	NA	NA	15 mg/l	1/3Months	Grab
Total Petroleum Hydrocarbon	4	NA	NA	NA	NL	1/Year	Grab
Acute Whole Effluent Toxicity	3	NA	NA	NA	1.0 TUa	1/Year	Grab

NA = Not Applicable
NL = No Limitations

The basis for the limitations codes are:
1. Federal Effluent Requirements
2. Best Engineering Judgement
3. Water Quality Standards
4. Other (model, WQM Plan, etc.)
5. Best Professional Judgement

24. Anti-Backsliding:

Because all effluent limits are continued unchanged, their re-issuance complies with the anti-backsliding provisions of the regulations.

25. Compliance Schedules:

There are no compliance schedules in effect for the facility.

26. Special Conditions:

The draft permit contains the following special conditions:

a. **Notification Levels:** The permit includes a special condition which requires the permittee to notify the Department if they discharge certain toxic pollutants above established concentrations. (Part I.B.1)

Rationale: The regulations (9 VAC 25-31-200) require **all** commercial facilities permitted under the VPDES program to comply with this notification requirement.

b. **Materials Handling/Storage:** The permit includes a special condition which requires that all product, materials and industrial wastes be handled, disposed of, and/or stored in such a manner so as not to permit a discharge to State waters. (Part I.B.2)

Rationale: This Special Condition is continued from the existing permit. 9 VAC 25-31-50 A prohibits the discharge of any wastes into State waters unless authorized by permit. Code of Virginia §62.1-44.16 and 62.1-44.17 authorizes the Board to regulate the discharge of industrial waste or other waste.

c. **Resumption of Monthly and Quarterly Monitoring:** The permit includes a special condition which requires the facility to resume monthly monitoring should the facility be issued a Warning Letter, a Notice of Violation, or be the subject of an active enforcement action (Part I.B.3).

Rationale: The reduction of monitoring is based upon past performance, and the facility is expected to maintain the performance levels that were used as the basis for granting monitoring reductions.

d. **Additional Monitoring and Reporting Requirements:** The permit includes special conditions which specify additional monitoring and reporting requirements for the Part I.A monitoring parameters (Part I.B.4).

Rationale: Authorized by VPDES Permit Regulation, 9 VAC 25-31-190 J 4 and 220 I. This condition is necessary when toxic and conventional pollutants are monitored by the permittee and a maximum level of quantification and/or a specific analytical method is required in order to assess compliance with a permit limit or to compare effluent quality with a numeric criterion. The condition also establishes protocols for calculation of reported values.

e. **Total Maximum Daily Load (TMDL) Re-opener:** The permit includes a special condition which allows the permit to be modified if any approved wasteload allocation procedure, pursuant to Section 303(d) of the Clean Water Act, imposes wasteload allocations, limits or conditions on the facility that are not consistent with the requirements of this permit. (Part I.B.5)

Rationale: Section 303(d) of the Clean Water Act requires that TMDLs be developed for streams listed as impaired. This special condition is to allow the permit to be reopened if necessary to bring it into compliance with any applicable TMDL approved for the receiving stream. The re-opener recognizes that, according to Section 402(o)(1) of the Clean Water Act, limits and/or conditions may be either more or less stringent than those contained in this permit. Specifically, they can be relaxed it they are the result of a TMDL, basin plan, or other wasteload allocation prepared under section 303 of the Act.

f. **O&M Manual Requirement:** The permit requires that the facility develop and maintain an Operation & Maintenance manual for the treatment works. The condition also requires that the manual be submitted to the DEQ regional office for staff approval within 90 days of the effective date of the permit. (Part I.B.6)

Rationale: Required by Code of Virginia § 62.1-44.16; VPDES Permit Regulation, 9VAC25-31-190 E, and 40 CFR 122.41(e). These require proper operation and maintenance of the permitted facility. Compliance with an approved O&M manual ensures this.

g. **Whole Effluent Toxicity Monitoring:** The permit includes a special condition which outlines the requirements for the acute whole effluent toxicity limitation required in Part I.A of the permit. (Part I.B.7)

Rationale: This special condition is necessary to specify additional requirements which apply to the effluent limitation.

h. **tPCB Monitoring:** The permit contains special conditions which require PCB monitoring of the discharge. (Part I.B.8)

Rationale: Because the receiving stream is listed for non attainment of the water quality standards due to the presence of PCB's, and the Department has an approved TMDL which contains a tPCB waste load allocation for the discharge, the permittee is required to submit data to confirm compliance with the adopted waste load allocation.

i. **Storm Water Management:** The permit contains special conditions for the management of storm water runoff from the site. (Part I.C)

Rationale: Because storm water runoff from the facility is defined in the regulations as "storm water associated with industrial activity" the storm water management conditions are required by 9 VAC 25-31-10.

j. **Conditions Applicable to all VPDES Permits:** The permit contains special conditions and other requirements which apply to all VPDES permits (Part II).

Rationale: VPDES Permit Regulation, 9 VAC 25-31-190 requires all VPDES permits to contain or specifically cite the conditions listed.

27. Variances/Alternate Limits or Conditions:

- A certified operator is not required for the wastewater system, since gravity sedimentation is the only treatment provided.

- Although outfall 001 discharges storm water runoff, the permit allows for a variance from standard storm water monitoring procedures that require sampling during the first 30 minutes of discharge. The amount of equalization provided by the treatment system sedimentation basins negates the benefit of sampling the "first flush" of the treatment system. Therefore, grab samples are specified as the sample type contained in Part I.A of the permit.

28. Proposed Changes to the Permit:

The following changes to the permit are proposed in this permit action:

a. Benchmark monitoring of TPH in accordance with the multi-sector storm water permit requirements at outfall 001 has been added to the permit;
b. The Reporting Special Condition (Part I.B.4) has been changed to reflect current agency recommendations;
c. A monitoring requirement for tPCBs has been added to the permit to measure compliance with the approved TMDL wastload allocation;
d. A Special Condition requiring an O&M Manual has been added to the permit (Part I.B.6), and;
e. Part I.C Storm Water Management Conditions has been modified to reflect current storm water permit

requirements.

No other changes are proposed.

29. <u>Public Notice</u>**:**

In accordance with 9 VAC 25-31-290, a public notice will be published once per week for two consecutive weeks in a newspaper of general circulation in the area affected by the discharge. A copy of the public notice and all pertinent information is on file and may be inspected or copied by contacting:

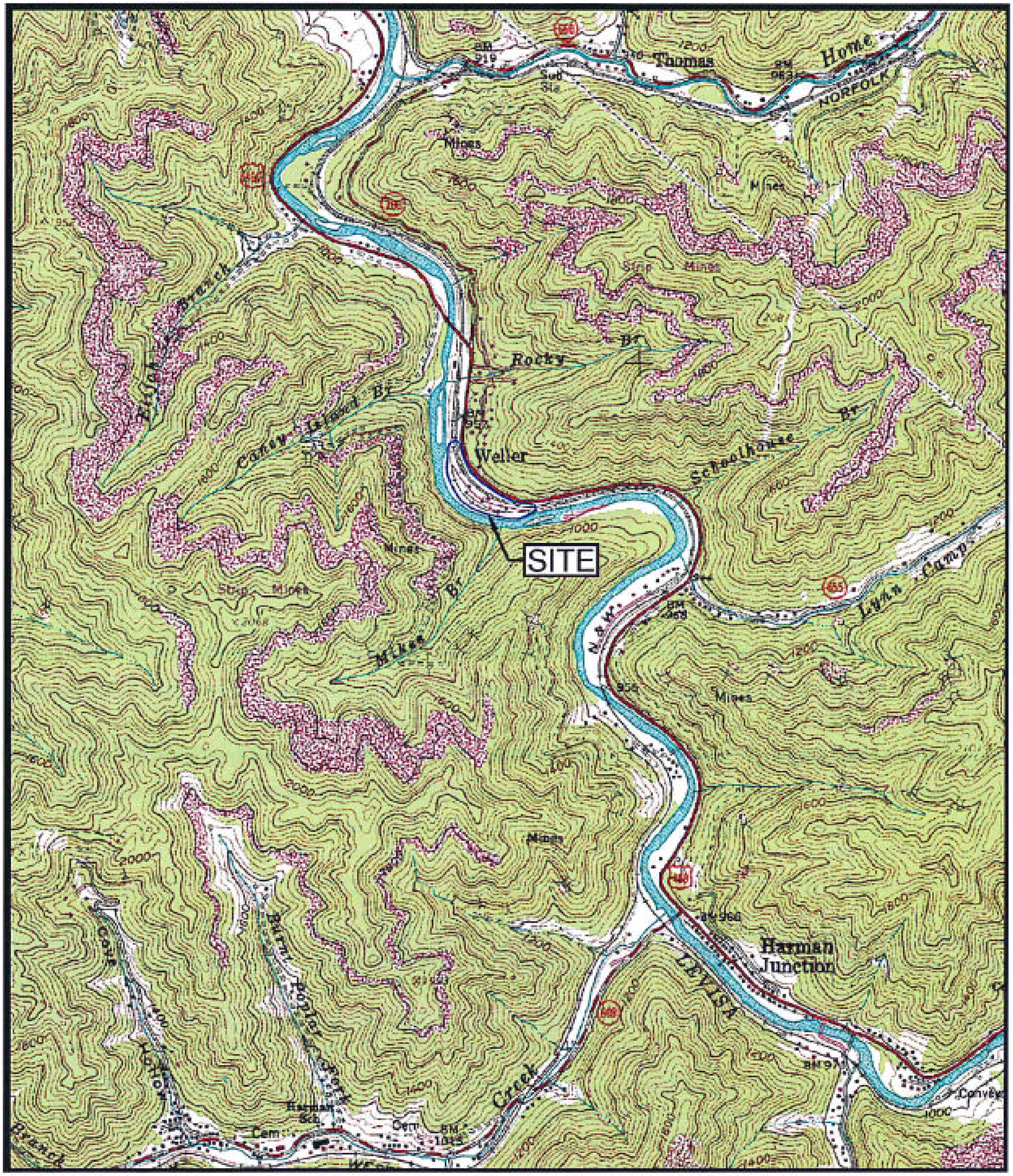
Mark Trent (mark.trent@deq.virginia.gov)
Department of Environmental Quality
Southwest Regional Office
355 Deadmore Street
P.O. Box 1688
Abingdon, VA 24212-1688

Persons may comment in writing, or by e-mail to the DEQ on the proposed issuance of the permit, and may request a public hearing, during the comment period. Comments shall include the name, address, and telephone number of the writer, and shall contain a complete, concise statement of the factual basis for comments. Only those comments received within this period will be considered. The DEQ may decide to hold a public hearing if public response is significant. Requests for public hearings shall state the reason why a hearing is requested, the nature of the issues proposed to be raised in the public hearing and a brief explanation of how the requester's interests would be directly and adversely affected by the proposed permit action.

Following the comment period, the Board will make a determination regarding the proposed permit action. This determination will become effective, unless the DEQ grants a public hearing. Due notice of any public hearing will be given.

Public Notice Beginning date: ________________

Public Notice End date: ________________



NORFOLK SOUTHERN RAILWAY COMPANY - WELLER YARD
CENTRAL PORTION OF USGS 7.5' HARMAN, VA. QUADRANGLE

Prepared by:

MARSHALL MILLER & ASSOCIATES

Prepared for:

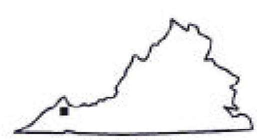
NS

2,000' 0 2,000'

SCALE 1:24,000

TOPOGRAPHIC SITE VICINITY MAP

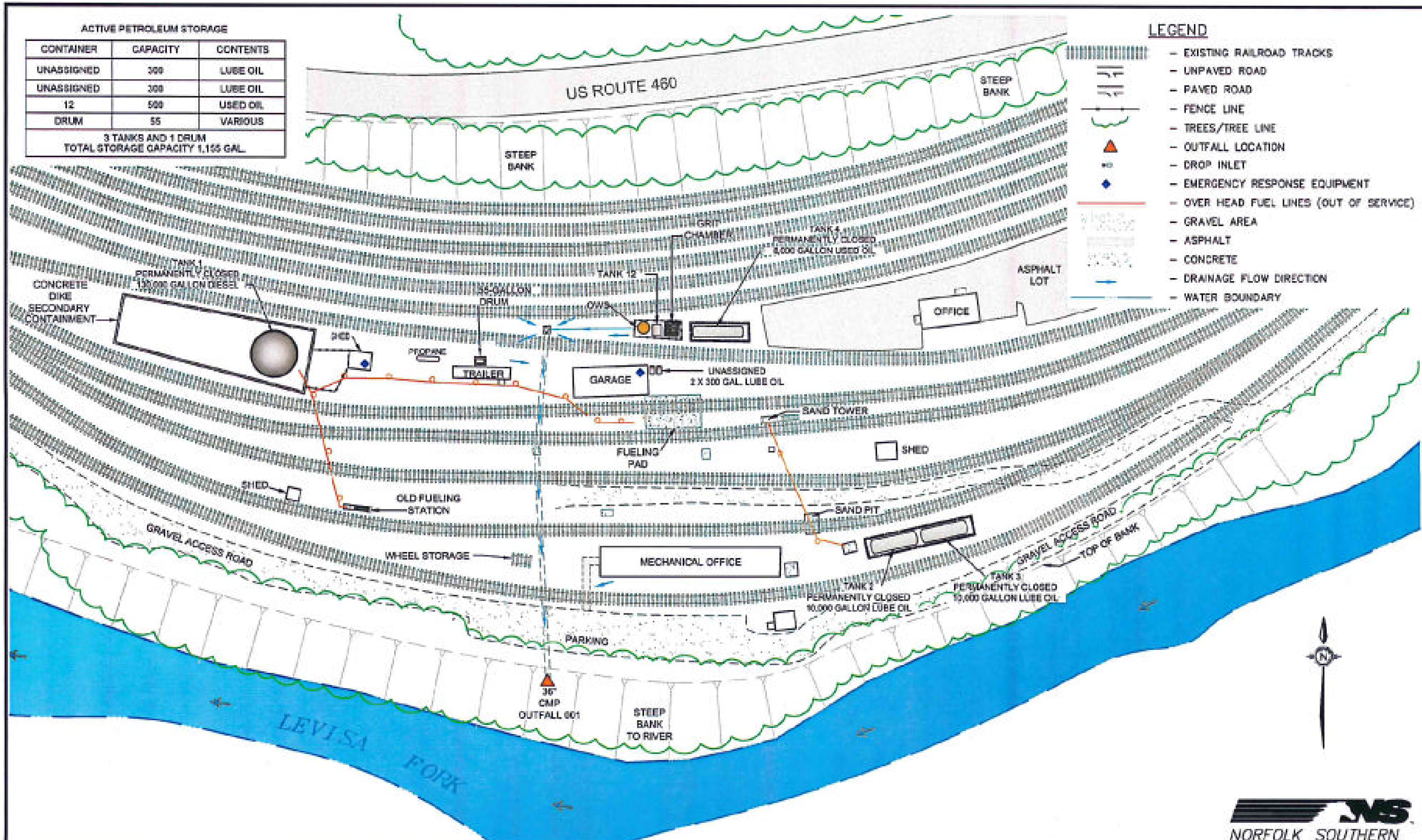
FIGURE 1



VIRGINIA
QUADRANGLE LOCATION

ACTIVE PETROLEUM STORAGE

CONTAINER	CAPACITY	CONTENTS
UNASSIGNED	300	LUBE OIL
UNASSIGNED	300	LUBE OIL
12	500	USED OIL
DRUM	55	VARIOUS
3 TANKS AND 1 DRUM TOTAL STORAGE CAPACITY 1,155 GAL.		



NORFOLK SOUTHERN

Prepared by Marshall Miller & Associates

DESIGNED	
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DATE	
FILENAME	

NORFOLK SOUTHERN RAILWAY COMPANY
WELLER RAIL YARD
GRUNDY, VIRGINIA

FACILITY LAYOUT
AND DRAINAGE MAP

PROJECT NO.

FIGURE
2

Norfolk Southern Railway Company
Weller Yard, Buchanan County, Virginia
VPDES Permit Number: VA0052639

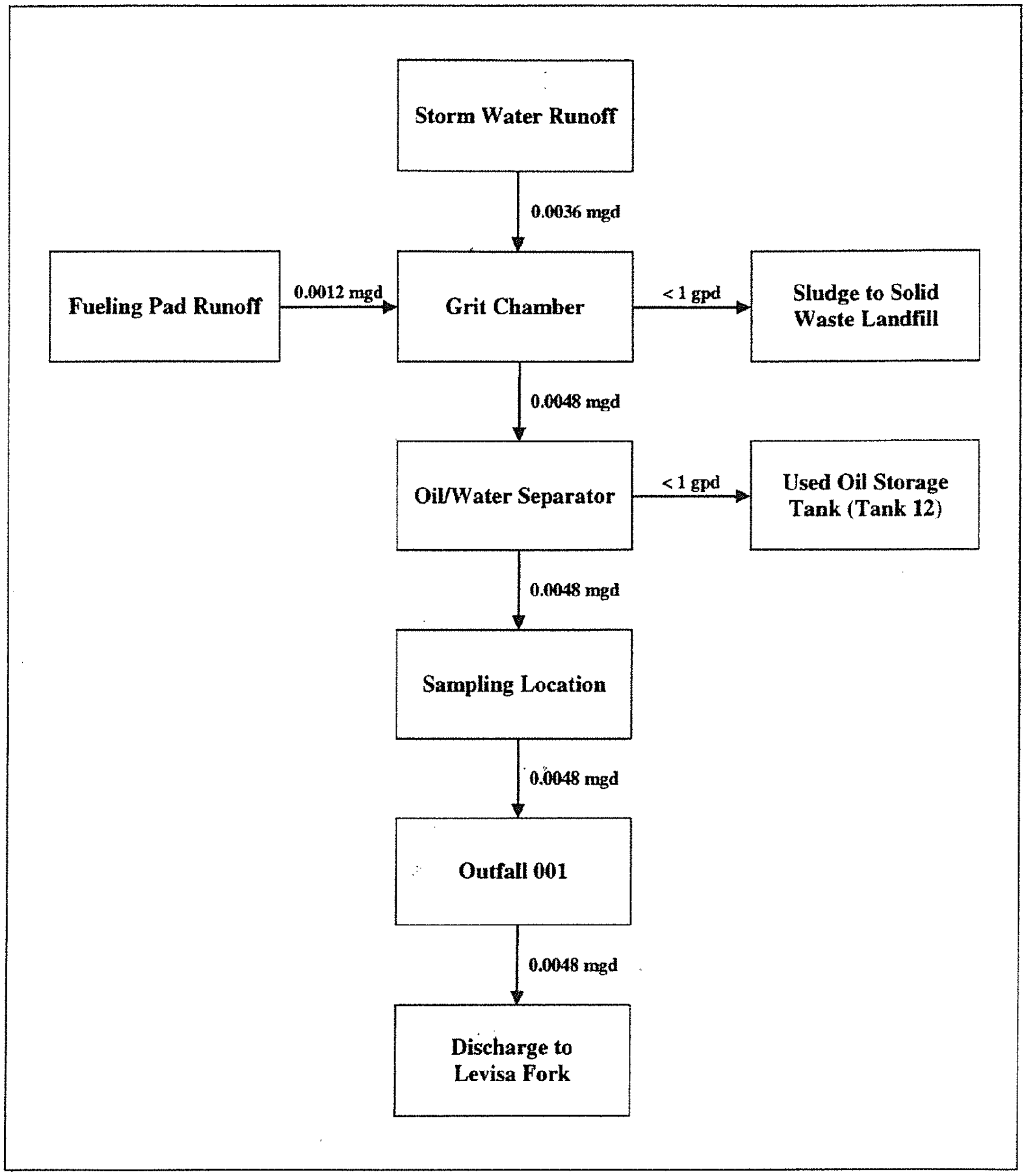

Figure 3 – Process Flow Diagram

12. TOTAL PCB (tPCB) WATER QUALITY ASSESSMENT

12.1 Introduction to PCBs

Polychlorinated biphenyls (PCBs) are a group of synthetic chemicals that consist of 209 individual compounds (known as congeners), and when summed are defined as total PCBs (tPCBs). PCBs consist of either oily liquids or solids and are colorless to light yellow in color with no known smell or taste. Each of the 209 possible PCB compounds consists of two sigma bonded, chlorine substituted phenyl groups (Figure 12.1) and for each congener, the chlorine substitutes differ in their number and position. PCBs are relatively inert and non-reactive to heat and other chemicals, which provides excellent properties for applications of high heat exposure and flame resistance. When released to the environment, these same properties cause PCBs to break down slowly and to bioaccumulate in fatty tissue of biota. PCBs do not naturally occur.

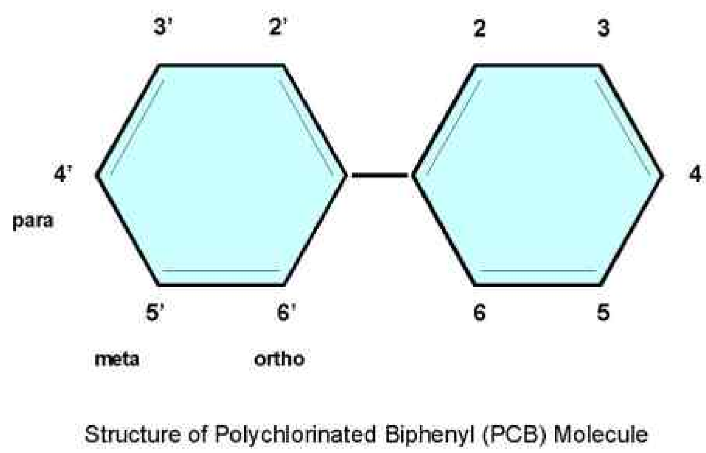

Figure 12.1 Chemical structure of a PCB molecule.
(from: http://www.epa.gov/hudson/pcbs101.htm available 6/20/2008)

Until the late 1970's, PCBs were manufactured and marketed in the United States under the trade name Aroclor. These compounds were used in many applications including capacitors, transformers, hydraulic fluid, plasticizers (sealants and caulk), adhesives, fire retardants, inks, lubricants, pesticide extenders, paints, mineral oil, carbonless copy paper, etc. By 1979, new PCB production was completely banned although continued use of properly functioning PCB containing equipment such as transformers was allowed (EPA http://fn.cfs.purdue.edu/fish4health/HealthRisks/tPCB.pdf, 6/20/2008).

Historically, PCBs were introduced to the environment through discharges from point sources and through spills and releases. Although point source contributions should now be controlled, facilities could be unknowingly discharging PCB loads as a result of historical or inadvertent contamination. Sites with PCB-contaminated soils from past spills can also act as precipitation-driven nonpoint sources. In addition, the widespread use of PCBs before their ban coupled with their stable molecular structure has caused a generalized distribution of the pollutant in air, soil, and water at background concentrations. Once in a waterbody, PCBs become associated with sediment particles and since they are very resistant to breakdown, PCBs can remain in river sediments for decades. They are also available to aquatic life based on their lipophilic (fat loving) nature and will readily accumulate in the fatty tissues of the aquatic biota. When PCBs are present in the environment, all forms of aquatic life are exposed. When the higher organisms (i.e., fish) consume lower trophic levels, PCBs that have accumulated in the lower organisms concentrate in the higher trophic levels thus increasing their overall body burden. The process of PCBs transferring from lower to higher trophic levels within a food chain is known as biomagnification. This is important as the top trophic levels (i.e., sport fish) are sought by and consumed by humans and is the leading cause of PCB exposure (ATSDR, 2000).

PCB exposure has been shown to be detrimental to human health. Acute exposures to elevated concentrations have caused acne-like skin lesions, hearing/vision problems, and spasms. Chronic exposures have been linked to deleterious effects to the gastrointestinal, hematological (blood), dermal (skin), endocrine (hormonal), immunological, neurological, and reproductive systems. The EPA has classified tPCBs as a probable human carcinogen.

12.2 Levisa Fork Impairments

The Levisa Fork mainstem is under a (VDH) fish consumption ban due to tPCB contamination from the Virginia/Kentucky state line upstream to the Slate Creek confluence (approximately 14 stream miles). In addition, a fish consumption advisory extends from the Levisa Fork's confluence with Slate Creek, upstream to the confluence with Contrary Creek (approximately 18 stream miles). A fish consumption advisory on Garden Creek extends from the confluence with Levisa Fork upstream to the confluence with the Right Fork of Garden Creek. Table 1.1 in Section 1.3 shows a full list of the impairments within the Levisa Fork watershed.

Of special note is the high degree of fish tissue contamination on Levisa Fork. When compared to a statewide fish tissue database, the tPCB concentrations (7,582 ppb wet weight basis) in fish samples collected from station 6ALEV130.00 near the Virginia/Kentucky state line are contained in the highest 1% of all tPCB samples in the Commonwealth (Figure 12.2).

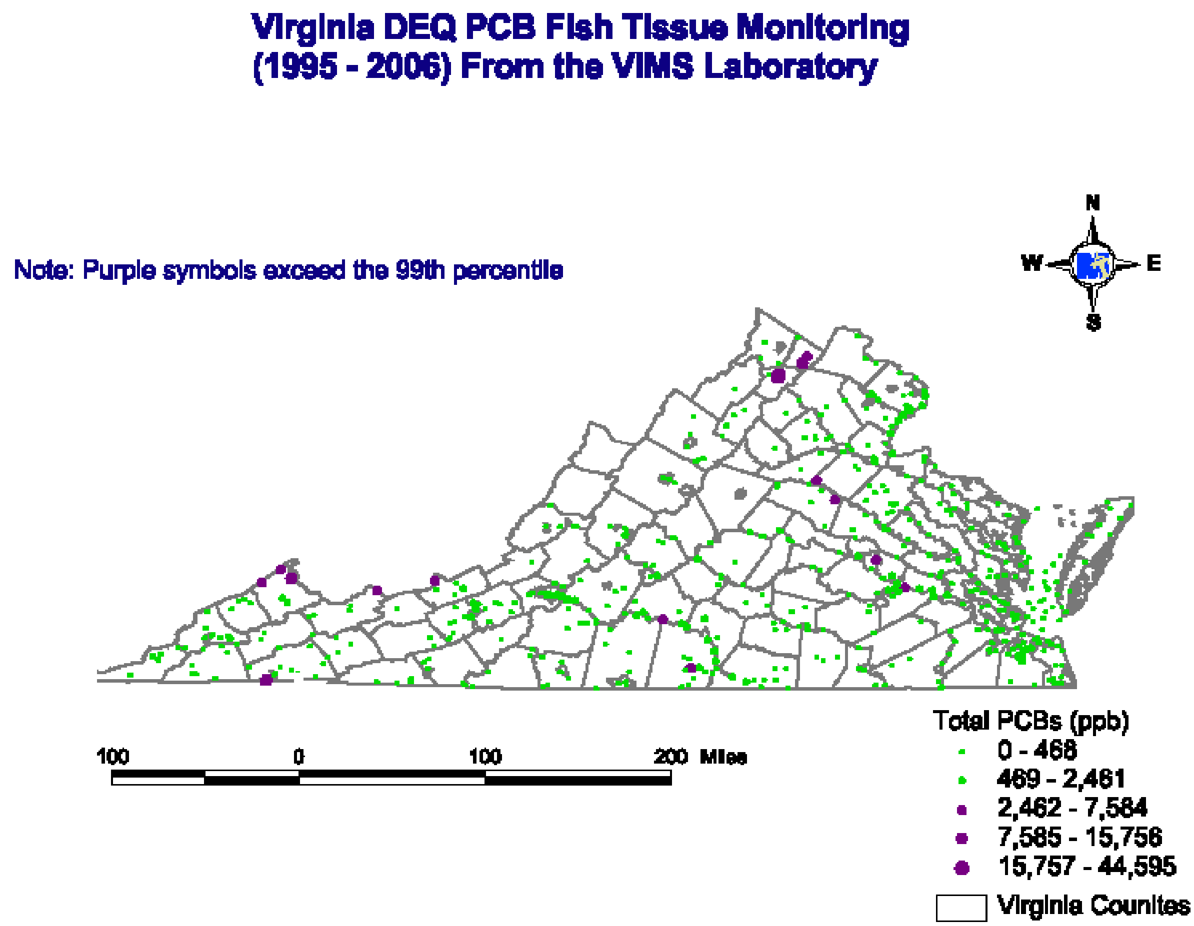

Figure 12.2 Virginia Institute Marine Science (VIMS) laboratory fish tissue tPCB data collected throughout Virginia from 1995-2006.

12.3 PCB Standards

As referenced in Section 2.1 (also see state regulation 9 VAC 25-260-10), Virginia's waters are to support the propagation of aquatic life, including game fish, and provide for edible fish. Virginia's water quality standards for the maintenance of designated uses include numeric Aroclor PCB criteria for the protection of aquatic life and a tPCBs criterion for the protection of human health (9 VAC-25-260-140.B). The state numeric values are based on criteria developed by EPA as issued in its 1999 Final Rule: *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance—Revision of Polychlorinated Biphenyls (PCBs) Criteria* (USEPA 1999).

The 1999 final rule is an update to the human health criterion and a restatement of the aquatic life criteria both established as part of the National Toxics Rule (NTR) issued in 1992. The reassessment used revised PCB cancer study results and information on environmental processes, representative classes of environmental PCB mixtures, and different exposure pathways to develop a range of cancer slope factors—0.07 per milligram per kilogram per day (mg/kg-d) (lowest risk and persistence) to 2.0 per mg/kg-d (high risk and persistence)—that indicate the potency of a cancer-causing chemical. EPA determined that the major pathway of human exposure to PCBs is fish consumption and that bioaccumulated PCBs are the most toxic. As a result, the upper-bound cancer slope factor (2.0 per mg/kg-d) was selected to develop the 1999 human health criterion. The EPA criterion incorporates a bioconcentration factor (BCF) to account for the uptake and accumulation of PCBs in fish tissues from contaminated waters.

VADEQ has also developed a numeric criterion for tPCB concentrations in fish tissue [54 micrograms per kilogram (µg/kg)]. Called a screening value (SV), it was developed using the same toxicological, exposure, and risk data used to develop the human health PCB criterion. The SV represents the fish tissue concentration that the Virginia water quality criterion is designed to protect, and is considered by VADEQ to be its fish tissue concentration equivalent (VADEQ, 2001).

The hydrophobic properties of PCBs make them difficult to detect in water quality samples. As a result, VADEQ has historically used fish tissue monitoring data as a surrogate to determine whether a waterbody is attaining the human health PCB criterion. If a fish tissue composite sample exceeds the SV, the water is classified as threatened for fish consumption. Fish containing a contaminant at or below the screening value concentration are considered to pose minimal risk to the average consumer. Related VDH fish consumption advisory guidelines specify a *do not eat* PCB concentration threshold of 500 ppb and a limited consumption (not more than 2 meals a month) PCB concentration range between 50 and 500 ppb. Advisories limiting and prohibiting fish consumption define waters as not supporting the fish consumption use, respectively (VADEQ, 2007).

VADEQ uses sediment PCB contamination data to assess the likelihood of an observed effect on aquatic life. Sediment monitoring data are compared to the Probable Effects Concentration (PEC) SV for sediment (676 ppb from MacDonald et al. 2000). This SV is considered to be protective of aquatic organisms exposed to PCBs in the sediment.

Based on EPA recommendations, the water column Human Health Chronic Standard will be used in PCB modeling (Table 12.1). The endpoint used in PCB modeling is consistent with Virginia's Water Quality Criterion of 640 pg/L (9 VAC-25-260-140). This criterion, developed in accordance with EPA guidelines, was designed to prevent fish from bioconcentrating PCBs to levels that presents increased potential risk to consumers of the fish. Attainment of the "fishable" goal should be met upon meeting the endpoint in-stream.

Table 12.1 Applicable water quality, fish tissue, and sediment criteria/guidelines for PCBs.

Standard Type	Agency	Criteria description	Pollutant	Aquatic Life Chronic Standard (ppb)	Human Health Chronic Standard (ppb)
Water Column	VADEQ	State water quality criteria [a]	PCB-1260	0.014	
			PCB-1254	0.014	
			PCB-1248	0.014	
			PCB-1242	0.014	
			PCB-1232	0.014	
			PCB-1221	0.014	
			PCB-1016	0.014	
			tPCBs		0.00064
Fish Tissue	VADEQ	State screening value	tPCBs		54
	VDH	Limited consumption threshold [b]	tPCBs		50 – 500
		Do not eat threshold	tPCBs		> 500
Sediment	VADEQ	State screening value based on Probable Effects Concentration [c]	tPCBs	676	

[a] Source: Virginia State Code 9 VAC-25-260-140.B
[b] Source: (VADEQ, 2001)
[c] Source: (MacDonald et al. 2000)

12.4 PCB Monitoring Data Inventory

VADEQ collects fish tissue and sediment samples as part of the Virginia Fish Tissue and Sediment Contaminants Monitoring Program. Under the program, data are collected to assess the human health risks for individuals who might consume fish from state waters and to identify impaired aquatic ecosystems. The sampling program is charged with monitoring every major watershed in Virginia at least once within a 2–3 year cycling period. From 1997 to 2007, VADEQ performed fish tissue sampling at nine sites in the Levisa Fork watershed (Figure 12.3). Since PCBs have a strong affinity for solids, VADEQ performed sediment sampling at 18 sites on the Levisa Fork from 1990 to 2002 and at one site on Garden Creek during 1997 and again in 2002. Water column PCBs were monitored in Levisa Fork during fall 2007 and spring 2008 as a special study conducted by VADEQ.

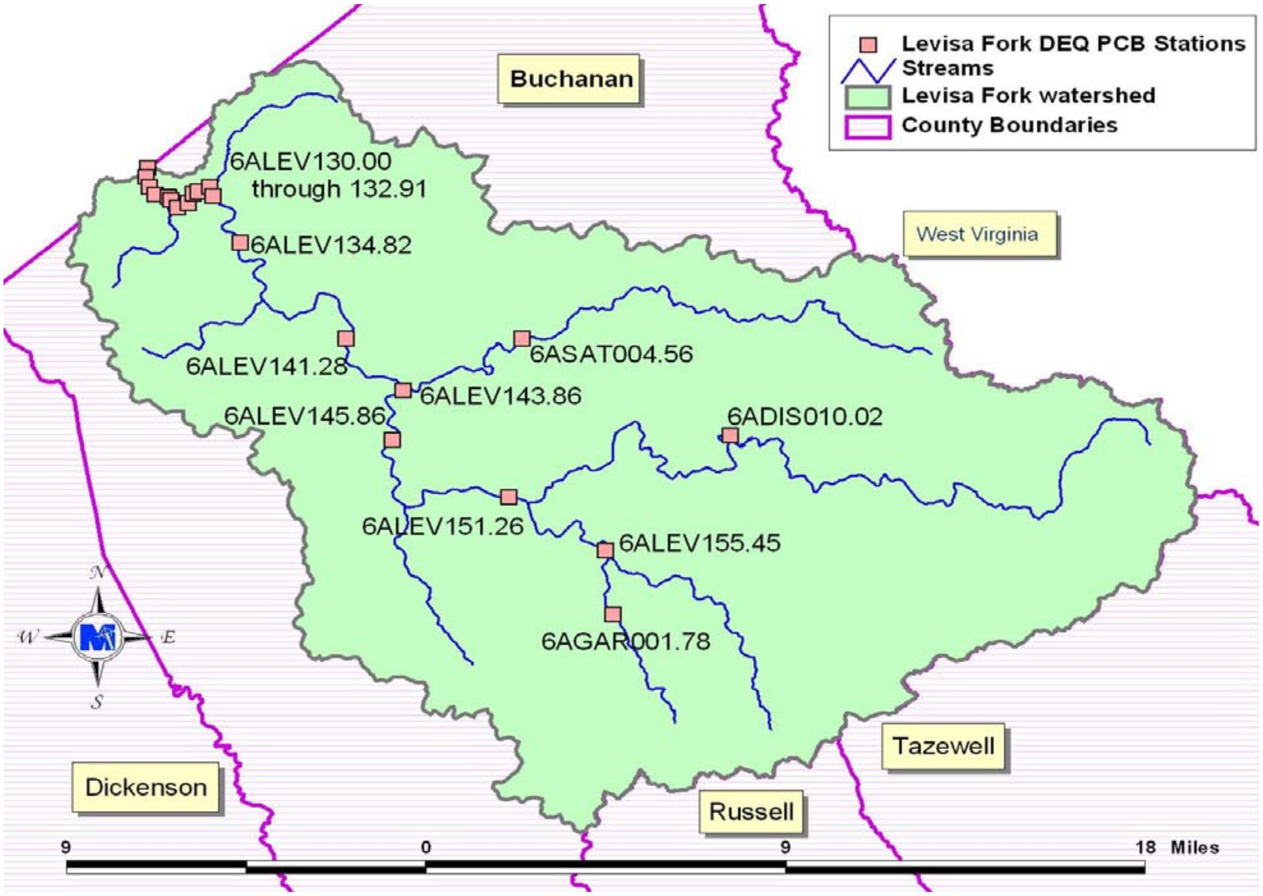

Figure 12.3 VADEQ streambed sediment and fish tissue monitoring for tPCBs in the Levisa Fork watershed.

12.4.1 Fish Tissue Data

Nine species of fish targeted for tissue samples include: Channel Catfish, Gizzard Shad, Golden Redhorse Sucker, Northern Hogsucker, Rainbow Trout, Redhorse Sucker, Rock Bass, Smallmouth Bass, and Stoneroller. These fish species are targeted since they represent different trophic levels as well as diverse feeding strategies.

12.4.1.1 Levisa Fork Mainstem

At the most downstream station (6ALEV130.00), 96% of the fish tissue samples were above the VDH limited consumption threshold (50 ppb) and 61% were above the VDH do not eat threshold (500 ppb) (Table 12.2). A gizzard shad sample collected at station 6ALEV130.00 during October 2000 yielded one of the higher PCB values (7,584 ppb wet weight) recorded from Virginia's Fish Tissue Monitoring Program. Tissue samples collected at station 6ALEV130.00 in 2007 suggest PCB levels may be on the decline (mean PCB conc. 973 ppb, n = 8), but from the same sample set an individual redhorse sucker yielded a concentration of 3,009 ppb and two channel catfish samples averaged 1,448 ppb.

At the next upstream station (6ALEV134.82), 60% of the fish tissue samples were above the lower threshold while 20% were above the do not eat threshold. Moving upstream, river stations 6ALEV141.28, 6ALEV145.86 6ALEV151.26 resulted in greater than 55% (n = 18) exceedance of VDH's lower threshold. Fish tissue samples collected at the most upstream station (6ALEV155.45) were below the limited fish consumption threshold (50 ppb).

Table 12.2 Fish tissue tPCB sampling results from six VADEQ monitoring stations on Levisa Fork.

Station	Date	Fish species name	VDH Action Level[1]	Total tPCB wet weight basis, ppb[2]
6ALEV130.00	07/22/97	Gizzard Shad	50	**1,182**
	07/22/97	Golden Redhorse Sucker	50	**1,448**
	07/22/97	Northern Hogsucker	50	**102**
	07/22/97	Rock Bass	50	**735**
	08/08/00	Channel Catfish (A)	50	**414**
	08/08/00	Channel Catfish (B)	50	**1,332**
	08/08/00	Northern Hogsucker (A)	50	**321**
	08/08/00	Northern Hogsucker (B)	50	20
	08/08/00	Rock Bass	50	**328**
	10/03/00	Gizzard Shad	50	**7,584**
	08/6/02	Rock Bass	50	**2,148**
	08/6/02	Rock Bass	50	**531**
	08/6/02	Channel Catfish	50	**1,244**
	08/6/02	Channel Catfish	50	**2,158**
	08/6/02	Northern Hogsucker	50	**5,403**
	07/17/07	Redhorse Sucker	50	**3,009**
	07/17/07	Channel Catfish	50	**1,868**
	07/17/07	Channel Catfish	50	**1,028**
	07/17/07	Northern Hogsucker	50	**908**
	07/17/07	Rock Bass	50	**325**
	07/17/07	Smallmouth Bass	50	**274**
	07/17/07	Smallmouth Bass	50	**214**
	07/17/07	Stoneroller	50	**155**
	07/17/07	Redhorse Sucker	50	**3,009**
	07/17/07	Channel Catfish	50	**1,868**
6ALEV134.82	08/08/00	Channel Catfish	50	**61**
	08/08/00	Gizzard Shad	50	**609**
	08/08/00	Redhorse Sucker	50	**151**

	08/08/00	Rock Bass (A)	50	44
	08/08/00	Rock Bass (B)	50	5

[1]VDH limited consumption threshold , ppb; **bold** values exceed the VDH treshold; [2]ppb = parts per billion (µg/kg), wet weight basis edible fillet

Table 12.2 Fish tissue tPCB sampling results from six VADEQ monitoring stations on Levisa Fork (continued).

Station	Date	Fish species name	VDH Action Level[1]	Total tPCB wet weight basis (ppb)[2]
6ALEV141.28	10/03/00	Channel Catfish	50	**280**
	10/03/00	Northern Hogsucker	50	22
	10/03/00	Rock Bass	50	42
	10/03/00	Smallmouth Bass (A)	50	**69**
	10/03/00	Smallmouth Bass (B)	50	37
6ALEV145.86	10/03/00	Channel Catfish	50	**54**
	10/03/00	Gizzard Shad	50	**413**
	10/03/00	Northern Hogsucker	50	6
	10/03/00	Redhorse Sucker	50	**67**
	10/03/00	Rock Bass	50	3
	10/03/00	Smallmouth Bass	50	**59**
6ALEV151.26	08/09/00	Gizzard Shad (A)	50	**119**
	08/09/00	Gizzard Shad (B)	50	**499**
	08/09/00	Rock Bass	50	8
	07/17/07	Channel Catfish	50	**110**
	07/17/07	Redhorse Sucker	50	**50**
	07/17/07	Northern Hogsucker	50	4
	07/17/07	Rock Bass	50	3
6ALEV155.45	08/09/00	Northern Hogsucker	50	27
	08/09/00	Rainbow Trout	50	29
	08/09/00	Rock Bass (A)	50	22
	08/09/00	Rock Bass (B)	50	29
	08/09/00	Smallmouth Bass (A)	50	12
	08/09/00	Stoneroller	50	9

[1]VDH limited consumption threshold, ppb; **bold** values exceed the VDH threshold; [2]ppb = parts per billion (µg/kg), wet weight basis edible fillet

12.4.1.2 Levisa Fork Tributaries

Only one tissue sample from Dismal Creek (6ADIS010.02) in 1997 (50.13 ppb) and one sample from Garden Creek (6AGAR001.78) in 2002 (180.46 ppb) exceeded the VDH lower threshold level (50 ppb) (Table 12.3). A total of 6 tissue samples collected during 2002 and 2007 from Slate Creek (6ASAT004.56) were below VDH's lower threshold level (mean conc. = 16 ppb).

Table 12.3 Fish tissue sampling results for tPCB from three VADEQ monitoring stations on Levisa Fork tributaries.

Stream	Station	Date	Fish species name	VDH Lower Level[1], (ppb[2])	Total tPCB wet weight basis, (ppb[2])
Dismal Creek	6ADIS010.02	06/19/97	Rock Bass	50	7.76
	6ADIS010.02	06/19/97	Rock Bass	50	3.78
	6ADIS010.02	06/19/97	Smallmouth Bass	50	11.43
	6ADIS010.02	07/22/97	Channel Catfish	50	**50.13**
	6ADIS010.02	08/06/02	Northern Hogsucker	50	3.57
	6ADIS010.02	08/06/02	Rock Bass	50	1.68
	6ADIS010.02	07/18/07	Northern Hogsucker	50	1.77
	6ADIS010.02	07/18/07	Rainbow Trout	50	10.50
Garden Creek	6AGAR001.78	06/19/97	Northern Hogsucker	50	13.76
	6AGAR001.78	06/19/97	Rock Bass	50	11.74
	6AGAR001.78	06/19/97	Smallmouth Bass	50	14.59
	6AGAR001.78	08/07/02	Gizzard Shad	50	**180.46**
	6AGAR001.78	08/07/02	Northen Hogsucker	50	3.53
	6AGAR001.78	08/07/02	Rock Bass - 1	50	2.46
	6AGAR001.78	08/07/02	Smallmouth Bass	50	6.32
	6AGAR001.78	07/16/07	Northern Hogsucker-1	50	1.68
	6AGAR001.78	07/16/07	Rock Bass	50	0.81
	6AGAR001.78	07/16/07	Smallmouth Bass	50	4.69
	6AGAR001.78	07/16/07	Stoneroller	50	0.76
	6AGAR001.78	07/16/07	White Sucker	50	4.06
Slate Creek	6ASAT004.56	08/07/02	Rock Bass - 1	50	11.94
	6ASAT004.56	08/07/02	Smallmouth Bass	50	18.15
	6ASAT004.56	08/07/02	Northern Hogsucker	50	38.45
	6ASAT004.56	07/18/07	Northern Hogsucker-1	50	15.39
	6ASAT004.56	07/18/07	Rock Bass -1	50	5.96
	6ASAT004.56	07/18/07	Smallmouth Bass	50	7.6

[1]VDH limited consumption threshold, [2]ppb = parts per billion (µg/kg or ng/g); wet weight basis edible fillet; **bold** values exceed the VDH threshold.

12.4.2 Sediment Sampling Analysis and Summary

Since PCBs have a strong affinity for solids, VADEQ performed sediment sampling at 18 sites on the Levisa Fork from 1990 to 2002, at one station in Garden Creek during 1997 and 2002, and at one station in Slate Creek also during 1997 and 2002. Table 12.4 shows the results of these sampling efforts organized by year and moving from downstream to upstream stations. Given the prominent hydraulic gradient (steep slope) within the watershed, it is difficult, at many locations, to find depositional areas where sediments have settled to the streambed. During periods of elevated flow, the system is susceptible to scouring of streambed sediments, which can impact the ability to bracket nearby upland PCB sources. The following conclusions have been drawn from the existing data set:

- These data suggest tPCBs in sediments may be decreasing over time at stations 6ALEV130.00 and 6ALEV131.52 as the highest observed values in the data set occurred in 1990 (1,000 ppb) and 1992 (2,400 ppb). However, this observation is made with the caveat that high PCB levels measured in sediment can be hit or miss in a system like Levisa Fork due to the hydraulic gradient.

- Elevated PCB concentrations found at the Kentucky/Virginia stateline indicates this area is likely pre-disposed to sediment deposition. High sediment concentrations provide an on-going source of PCBs to aquatic life through partitioning to the water column as well as through re-suspension.

- The 2000 sediment collection shows relatively low values throughout Levisa Fork with a spike upstream of the Conaway Creek and Levisa Fork confluence.

- All samples upstream of Rocklick Creek, including samples from Garden Creek and Slate Creek, were at or below 500 ppb.

Table 12.4 Streambed sediment tPCB results from VADEQ monitoring.

Station	Station Location	Date	Sediment tPCBs (ppb)
6ALEV130.00	Levisa Fork near KY-VA line	7/17/90	**1,000**
6ALEV130.00	Levisa Fork near KY-VA line	8/20/90	500
6ALEV130.00	Levisa Fork near KY-VA line	7/22/97	ND
6ALEV130.00	Levisa Fork near KY-VA line	08/08/00	1.32
6ALEV130.00	Levisa Fork near KY-VA line	08/06/02	**894.89**
6ALEV130.25	Levisa Fork last bridge near KY-VA line	10/03/00	17.93
6ALEV130.52	Levisa Fork upstream of Buckeye Branch	10/03/00	9.24
6ALEV130.79	Levisa Fork between Buckeye Branch and Conaway Creek	10/03/00	6.26
6ALEV131.14	Levisa Fork just downstream of Conaway Creek	10/03/00	49.98
6ALEV131.27	Levisa Fork just upstream of Conaway Creek	10/03/00	306.34
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	7/16/92	**2,400**
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	6/9/93	440
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	6/9/94	10
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	7/18/95	140
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	7/9/96	30
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	5/13/97	50
6ALEV131.52	Wellmore Coal Co.Dock #14 Bridge off 460	5/10/99	20
6ALEV131.88	Levisa Fork downstream of Unamed Trib	10/03/00	6.97
6ALEV132.16	Levisa Fork upstream of Unamed Trib	10/03/00	0.77
6ALEV132.31	Levisa Fork between Unamed Trib and Rocklick Creek	10/03/00	5.43
6ALEV132.62	Levisa Fork just downstream of Rocklick Creek	10/03/00	4.89
6ALEV132.91	Levisa Fork downstream of Harper Branch	10/03/00	2.31
6ALEV134.82	Levisa Fork downstream of Weller	08/08/00	3.35
6ALEV141.28	Levisa Fork upstream of Twentymile Creek	10/03/00	1.05
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	7/16/92	500
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	6/9/93	500
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	6/9/94	30
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	8/14/95	210
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	7/9/96	40
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	9/2/97	60
6ALEV143.86	Steel Bridge on Railroad Ave off Rt 83	5/10/99	30
6ALEV145.86	Levisa Fork downstream of Tookland	10/03/00	1.29
6ALEV151.26	Levisa Fork downstream of Dismal Creek	08/09/00	4.54
6ALEV155.45	Levisa Fork near Oakwood	08/09/00	4.53
6AGAR001.78	Garden Creek near Garden Creek Mission Church	06/19/97	105.68
6AGAR001.78	Garden Creek near Garden Creek Mission Church	08/07/02	6.42
6ASAT004.56	Slate Creek near Buchanan Co. Vocational School	07/22/97	0.69
6ASAT004.56	Slate Creek near Buchanan Co. Vocational School	08/07/02	2.51

Bold values are above the PEC value for tPCB in sediment = 676 ug/kg

On September 12, 2000, EPA and the Virginia Department of Emergency Management (VDEM) conducted soil and sediment sampling in Levisa Fork near the Virginia-Kentucky state line. Ten soil samples and 10 sediment samples were collected in Levisa Fork and along the streambank. Of these samples, one sediment sample collected from the western streambank contained an Arolcor-1260 concentration of 1,600 ppb. Three additional soil samples that contained Arochlor-1260 were obtained from the vegetation line on the western bank, a sandbar in the middle of Levisa Fork, and a sandbar near the eastern bank. The samples from these sites had 240 ppb, 150 ppb, and 38 ppb of Aroclor-1260, respectively.

During the Route 460/Grundy Flood Control project managed by the Virginia Department of Transportation (VDOT), soil samples were collected and analyzed for tPCBs. One sample, taken north of Slate Creek near the confluence with Levisa Fork, contained 428 ppb of total Arochlor.

12.4.3 Water Column Sampling Analysis and Summary

VADEQ conducted a special study in Levisa Fork during fall 2007 and spring 2008. The study was designed to augment the existing water quality record in support of TMDL development. Water quality samples were collected during low-flow and high-flow conditions at 11 monitoring locations throughout the watershed. The study design was to help bracket potential source areas. Because of the hydrophobic properties of PCBs and insensitive analytical methods, samples collected for prior monitoring studies routinely failed to detect measurable concentrations of PCBs. These special study results were analyzed using a high-resolution, low-detection level analysis method (1668A) specifically to account for PCBs' hydrophobic properties and are presented as picograms/Liter (pg/L or parts per quadrillion). The tPCB concentrations are shown in Table 12.5.

Under low flow conditions, tPCB concentrations are well below the WQC of 640 pg/L. This is consistent with low TSS levels, showing that PCBs were not washing off upland contaminated sites during sample collection.

Elevated tPCB concentrations (Table 12.5 and Fig. 12.8) are found during high flow on Levisa Fork at stations 6ALEV131.52 (986 pg/L) and 6ALEV143.80 (836 pg/L), and on Dismal Creek at station 6ADIS001.24 (1,140 pg/L). Elevated tPCB concentrations during high Levisa Fork flows is not surprising since PCBs are associated with resuspended particulates from streambed sediments and newly introduced particles associated with the erosion of PCB contaminated upland soils.

Table 12.5 tPCB concentrations in the Levisa Fork watershed.

Ambient Location	Sample Date Low Flow	Total tPCB (pg/L) *	Sample Date High Flow	Total tPCB (pg/L) *
6ALEV131.52 - Levisa Fork	9/27/2007	23	3/5/2008	986
6AHME000.42 - Home Creek	9/27/2007	11.3	3/5/2008	104
6ABLC002.30 - Bull Creek	10/1/2007	52.4	3/5/2008	148
6ASAT000.26 - Slate Creek	10/23/2007	133	3/5/2008	323
6ALEV143.80 - Levisa Fork	9/27/2007	35	3/5/2008	836
6ABIP000.18 - Big Prater Creek	9/26/2007	0	3/5/2008	132
6ADIS001.24 - Dismal Creek	9/26/2007	8.3	3/5/2008	1,140
6A LEV152.46 - Levisa Fork	9/26/2007	5.7	3/5/2008	372
6AGAR000.16 - Garden Creek	9/26/2007	40	3/5/2008	537
6AGRF000.56 - Rt. Fk. Garden Creek	9/26/2007	13.2	3/5/2008	218
6ALEV156.82 - Levisa Fork	9/26/2007	141	3/5/2008	428

*Results corrected to account for slight background PCB concentration.

13. TOTAL PCB (tPCB) SOURCE ASSESSMENT

Information presented in this section includes the best available to date on point and nonpoint sources of PCBs in the Levisa Fork watershed. The development of PCB TMDLs in the Levisa Fork watershed is subject to adaptive implementation and on-going source investigation whereby sources of PCB contamination are continuously being reviewed and updated based on the best available information. The following discussion of PCB sources, therefore, should be considered the most up-to-date information at the time of the development of this TMDL, rather than a complete and final characterization. The discussion that follows is limited to identification of the sources represented in the TMDL.

For the purposes of this TMDL, sources of PCB loadings to a waterbody are defined as either current or legacy. Current sources generate PCB loads that have a defined, disruptable pathway to a waterbody. Such sources, in theory, can be controlled either by eliminating the source of PCBs or by blocking the pathway. Examples of current sources include PCB-contaminated soils that wash off from upland areas, leachate from landfills and industrial disposal areas, leaking transformers and storage containers, discharges of PCB-contaminated effluent, local deposition of atmospheric PCBs accumulated from off-gassing contaminated sites, and a variety of other sources.

Legacy sources generate PCB loads to a waterbody that cannot be easily controlled because there is no disruptable pathway from the source to the affected waterbody. Control of the source requires its direct removal. In all cases, the source exists at an interface with the waterbody where there is continuous exchange of material. Examples of legacy sources include in-stream contaminated sediments, stream bank soils that are not part of a contaminated site, biota, and background atmospheric deposition to surface waters.

Both current and legacy sources are represented in the TMDL model framework.

13.1 Permitted Discharges

Three VPDES and twelve coal facility permitted dischargers in the Levisa Fork watershed provided Total Polychlorinated Biphenyls (tPCB) data for use in the source assessment and development of existing loads for the impending tPCB TMDL (Table 13.1). These data were voluntarily generated by the permitted dischargers, as requested by VADEQ during a December 2007 meeting held in Grundy, Virginia. It was requested that permittees use EPA Method 1668 to generate the results. Detailed information was disseminated on sample collection and the analytical requirements needed to generate meaningful data relative to Virginia's tPCB Water Quality Criterion (WQC) of 640 picograms per liter (pg/L).

VADEQ's experience with Method 1668 has resulted in several laboratories demonstrating the capability of quantifying tPCB congeners at low levels. Since the method is performance based, there is enough latitude for laboratories to make the necessary modifications to attain reporting levels (EMLs) well below those presented in the EPA method.

Table 13.1 Total PCB (tPCB) data from permitted sources in the Levisa Fork watershed.

Permit ID	Facility	Outfall	Precipitation Influence	tPCB (pg/L)	Receiving Stream
	Conaway STP				
VA0090531	Treated wastewater effluent	1	Wet	3,061	Levisa Fork
VA0090531	Treated wastewater effluent	1	Dry	706	Levisa Fork
VA0090531	Treated wastewater effluent	1	Dry	1,104	Levisa Fork
	Jewel Smokeless Coal				
1200354		1	Wet	7	Dismal Creek
1200354		1	Dry	92	Dismal Creek
1300425		4	Wet	135	Dismal Creek
1300425		4	Dry	145	Dismal Creek
1300426		7	Wet	1,009	Dismal Creek
1300426		7	Dry	117	Dismal Creek
1201532		B	Wet	18	Dismal Creek
1201532		B	Dry	79	Dismal Creek
	Norfolk Southern Railway Co				
VA0052639	Stormwater discharge	1	Dry	43,839*	Levisa Fork
VA0052639	Stormwater discharge	1	Wet	45,027*	Levisa Fork
	Consol Coal				
1400047	Underground mine water at diffuser	33	Wet	19.3	Levisa Fork
1400047	Underground mine water at diffuser	33	Wet	25.6	Levisa Fork
1400047	Coal processing plant	3	Wet	93.4	
1400047	Coal processing plant	18	Wet	31.0	
1400047	Coal processing plant	21	Wet	63.8	
1400047	Coal processing plant	27	Wet	96.5	
1400047	Coal processing plant	3	Dry	48.1	
1400047	Coal processing plant	18	Dry	40.7	
1400047	Coal processing plant	21	Dry	42.3	
1400047	Coal processing plant	21	Dry	52.3	
1400047	Coal processing plant	27	Dry	53.1	
	Wellmore Coal				
1200282	SW Runoff deep mine face-up areas	1		5.2	
1200335	SW Runoff deep mine face-up areas	S-3		4.1	Enoch Branch
1201988	SW Runoff deep mine face-up areas	3		3.4	Horse Branch
1300451	SW Runoff from coal processing plant & rail car loading	4		2.6	Hackney Creek
1101736	SW from surface mining mixed with underground mine drainage	1		1.2	Burnt Poplar
1201539	SW from surface mining mixed with underground mine drainage	1		13.0	Smith Branch
1301640	SW Runoff from coal processing plant & rail car loading	003-S		194.3	Rockhouse Creek

*All tPCB congeners reported as non-detect at elevated reporting level. tPCB values based on 1/2 Estimated Minimum Level.

13.2 Nonpoint PCB Sources

13.2.1 Atmospheric Deposition

The widespread use of PCBs before their ban in the 1970s, coupled with their stable molecular structure, has caused a generalized distribution of the pollutant in air, soil, and water at background concentrations. The net flux of gaseous PCBs between the atmosphere and the surface of a waterbody is a function of the dynamic concentration gradient between the two. Atmospheric deposition has been shown to be a significant pathway of PCB cycling in freshwater systems (PADEP 2001). The value used in this project is 1.6 $\mu g/m^2/yr$ (CBP, 1999).

13.2.2 Streambed Sediments

Streambed sediments can contain significant concentrations of PCBs from historical or current loadings or both. These PCBs can be released to the water column by the resuspension of streambed sediments, by the desorption of PCBs at the streambed-water column interface, and by the direct diffusion of PCBs from lower contaminated sediment layers.

In-stream processes govern the movement and accumulation of streambed sediments. Contaminated streambed sediments are available for consumption by aquatic biota, are transported downstream, and can be buried under additional sediments. Downstream transport can result in flushing sediments out of the system or trapping sediments behind downstream dams. In two existing PCB projects, the Hudson River project in New York and the Housatonic River project in Massachusetts, historical discharges have contaminated sediment, which have collected in slow river stretches or reservoirs. These contaminated sediments tend to remain in such depositional areas until they are removed by dredging or dislodged by storms.

13.2.3 Known Contaminated Sites

There are six sites in the Levisa Fork watershed where tPCBs were spilled or released and the Virginia Department of Emergency Management (VDEM) was notified. These areas have been identified, assessed and reported to the EPA. It is important to discuss these incidents in this project, as similar tPCB spills are most likely occurring without the knowledge of local government and nearby citizens and are likely contributing on-going sources. If the following descriptions are familiar in an area not discussed here, please contact your local Hazardous Materials Officer (www.vaemergency.com/programs/hazmat/officers.cfm).

In March 1998, a local citizen contacted VDEM regarding an illegal dump with seven transformers and 75-100 batteries. The dump was located at the old Hobbs Grocery on Route 635 approximately 3.8 miles past the Dismal River Rescue Squad. The citizen reported that there was burning and breaking old mining equipment at this site. This site is in the Dismal Creek watershed (subwatershed 11). PCB soils or sediment data are unavailable.

A Virginia Department of Transportation (VDOT) staff member reported an illegal dump in October 1992. Along Route 610 off Route 460, at least three transformers were discovered. This site is in the Conaway Creek drainage area which empties into Levisa Fork near the Kentucky state line in subwatershed 8. PCB soils or sediment data are unavailable.

In January 1992, an illegal dump was reported near Whitewood, Virginia off Route 690 near Harry's Branch Creek. An unknown number of transformers and batteries were reported at this site, which is in the Dismal Creek watershed (subwatershed 11). A soil sample from Upper Harry's Branch collected in November 1994 had 799 ppm Aroclor 1260. More recent soil samples (August 2008) yielded average and median concentrations of 54.5 ppm and 1.7 ppm, respectively. Nearby sediment samples had a mean concentration of 0.012 ppm, while PCBs were not detected in the water samples (method 1668). This site is currently (fall 2009) undergoing remediation by EPA with a target clean-up level of 0.277 ppm.

Acid and tPCB dumping was reported at Left Fork Mine and Brookie Coal Mine near Pilgrims Knob, Virginia in February 1990. These areas were abandoned coal mine sites and evidence of transformer stripping showed possible tPCB contamination to the nearby stream at one location. Charred and melted transformer parts were noted, as well as an oil sheen on a nearby settling pond. Pictures, soil samples and water samples were collected. Three soil samples taken from the Left Fork Mine site ranged from Non Detected to 12 ppm tPCBs. The surface of the settling pond had 9.8 µg/L tPCBs. The Brookie Coal Mine site soil sample had 20 ppm tPCBs. This site is in the Dismal Creek watershed (subwatershed 11).

The final known site where tPCBs have been detected is in Grundy, Virginia at the R. C. Billards conveyer belt business. This location is off Route 460 near the Advance Auto Parts store. Aroclor 1254 was detected at 3,600 ppb in a water sample from a monitoring well on the business property. This sample was collected in August 1996.

These six sites are shown in subsequent maps as the approximate locations of known PCB spills.

13.2.4 General Data Trends that show Potential Unknown Contaminated Sites

The results of the fish tissue monitoring in Levisa Fork show a general trend toward higher tPCB values in fish near the watershed outlet where the river flows into Kentucky (Figure 13.1). The box and whisker plot shows the second quartile (Q2), third quartile (Q3), 10% of sample data, 90% of sample data, average (mean), minimum (min) and maximum (max) of all the fish tissue data collected from Levisa Fork by station. Even though fish are model in a stream system, this graph indicates the potential for a PCB source in between upstream station 6ALEV134.82 and downstream station 6ALEV130.00.

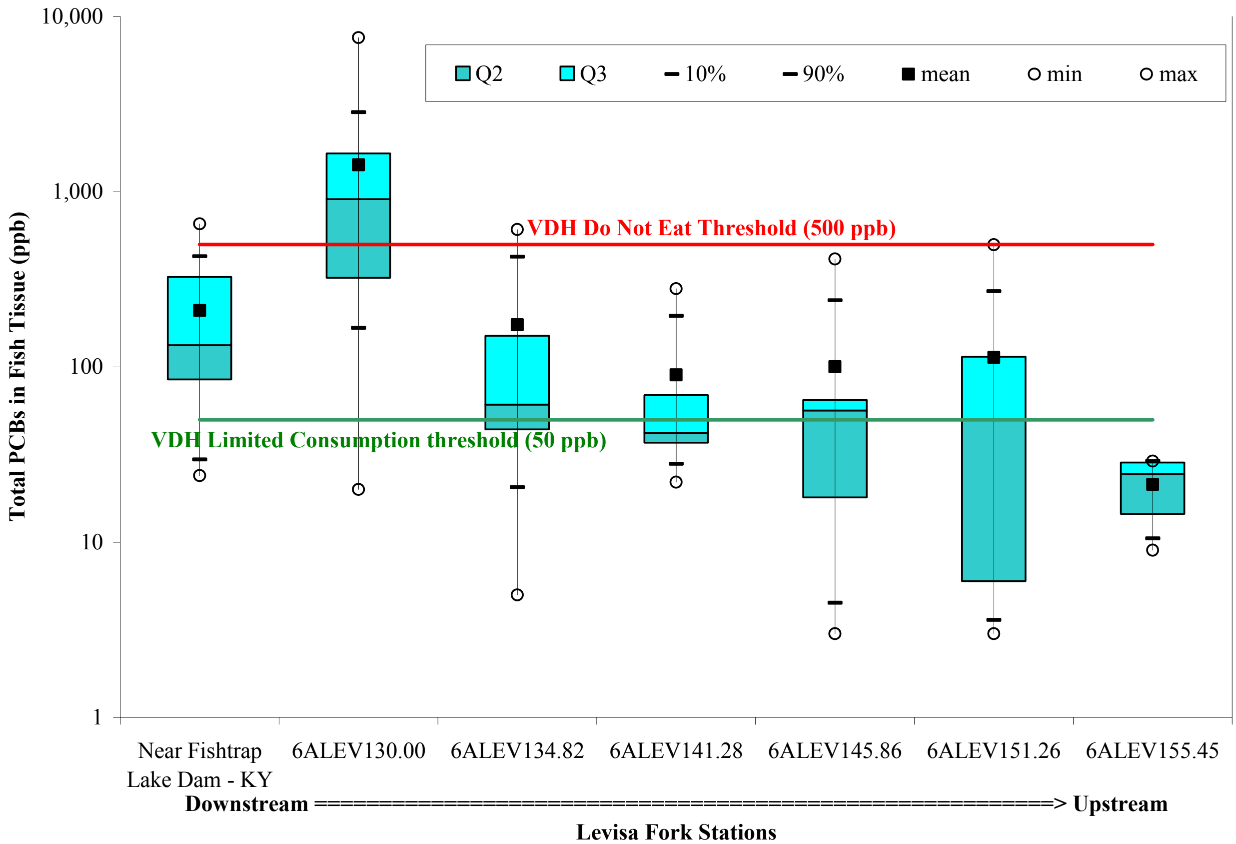

Figure 13.1 Levisa Fork fish tissue sample tPCB results organized downstream to upstream.

Since fish are mobile, it is difficult to pinpoint potential source areas based on these data. However, the data in Table 12.2 and Figure 13.2 both show there are elevated levels of tPCBs in the fish tissue of fish samples collected near the Kentucky-Virginia state line. The fish tissue tPCB concentrations are higher downstream of Dismal Creek starting at station 6ALEV151.26 and increase downstream to the outlet into Kentucky. Figure 13.2 shows the average fish tissue tPCB concentrations from all fish species from samples along the Levisa Fork and tributaries, as well as downstream of the project watershed. There is an obvious spike in the fish tissue tPCB data at station 6ALEV130.00 at the VA-KY state line. The tPCB concentrations in fish are also high downstream in Fishtrap Lake, but these levels are lower than at the state line, suggesting the contamination is not only from streambed sediments retained in Fishtrap Lake.

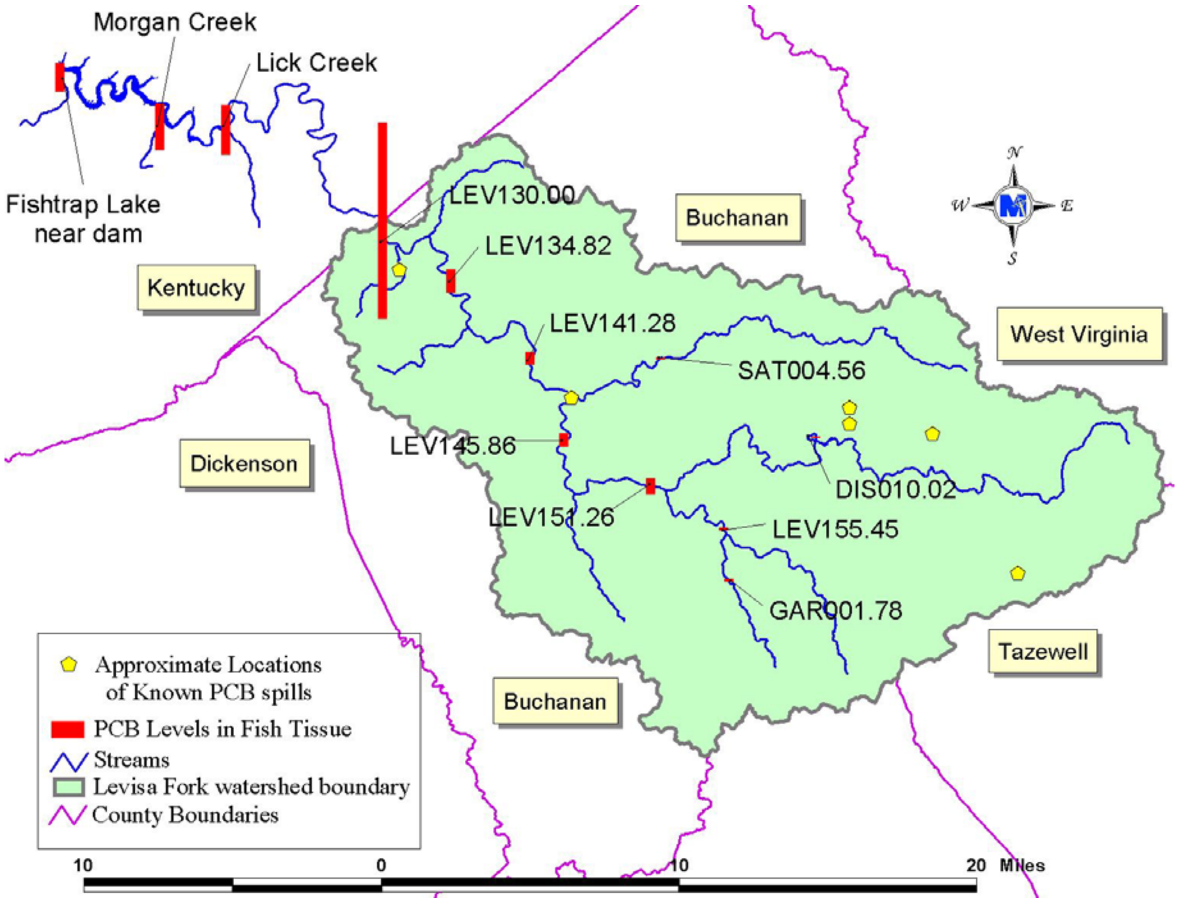

Figure 13.2 The locations and average concentrations of tPCBs in fish tissue samples in the Levisa Fork watershed and extending downstream into Fishtrap Lake, KY.

Another, less obvious, increase in the tPCB fish tissue data occurs between stations 6ALEV155.45 and 6ALEV151.26 on Levisa Fork. The average tPCB concentration jumps from 21 ppb at station 6ALEV155.45 to 113 ppb at downstream station 6ALEV151.26. The major tributary, Dismal Creek empties into Levisa Fork between these stations. Even though only one fish tissue sample was above the VDH lower level tPCB screening value (50 ppb) from the Dismal Creek station, this sampling station is 10.02 miles upstream. There may be sources of tPCBs in the downstream drainage area of Dismal Creek. There may also be a tPCB source along the Levisa Fork mainstem in between stations 6ALEV151.26 and 6ALEV155.45.

The VADEQ performed high and low flow water column PCB sampling sweeps in September and October 2007 and March 2008 to try and isolate areas of high tPCB contributions in the Levisa Fork watershed (Table 12.5). The high flow sampling sweep followed a significant rainfall event. Sampling station 6ALEV131.52 is very close to the USGS flow gage 03207800 on the Levisa Fork At Big Rock, VA. Drainage area adjusted flows were determined for every monitoring station in the sweep and tPCB loadings were calculated for high flow samples collected on March 5, 2008 (Figure 13.3). This map is shown to demonstrate the relative differences between the tPCB loads during one sampling event.

The results indicate that Dismal Creek was a significant source of tPCBs at the time of the sampling. One third of the total loading at monitoring station 6ALEV131.52 can be attributed to Dismal Creek. In addition, much of the loading at station 6ALEV131.52 can be attributed to unknown sources downstream of station 6ALEV143.80.

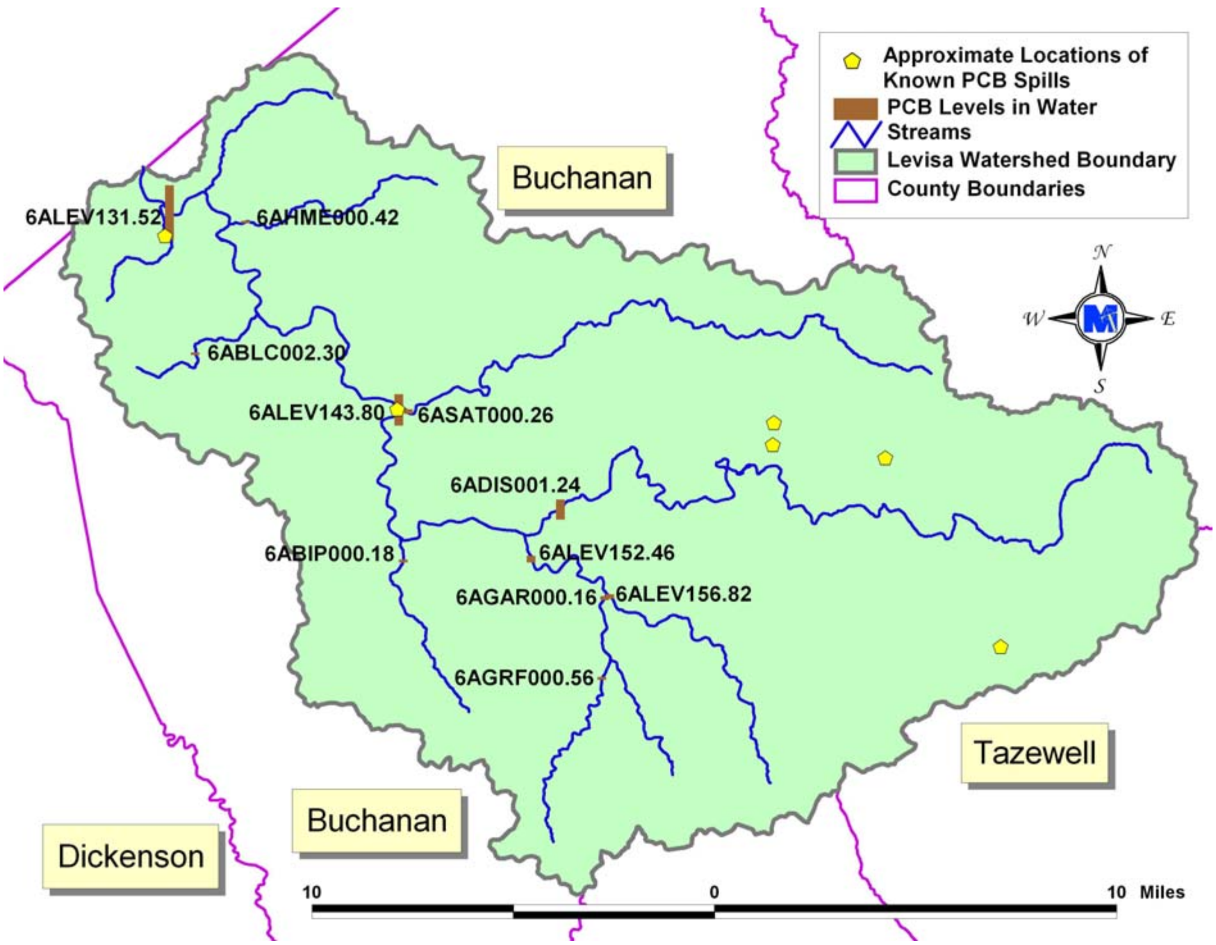

Figure 13.3 High flow tPCB loadings in the Levisa Fork watershed, March 5, 2008.

The tPCB in-stream sediment results are spotty. High values were detected in 1990, 1992, and 2002 at stations near the outlet of Levisa Fork. All samples upstream of Rocklick Creek, including samples from Garden Creek and Slate Creek, were at or below 500 ppb. Figure 13.4 shows the average tPCB concentrations in sediment for all data in the watershed. There is a PCB hot spot at the state line in the sediment data, ehich corresponds well to the higher fish tissue PCBs at the state line station (6ALEV130.00). There is a smaller spike in the sediment tPCB concentration at station 6ALEV143.86, which is near the outlet of Slate Creek where it empties into Levisa Fork.

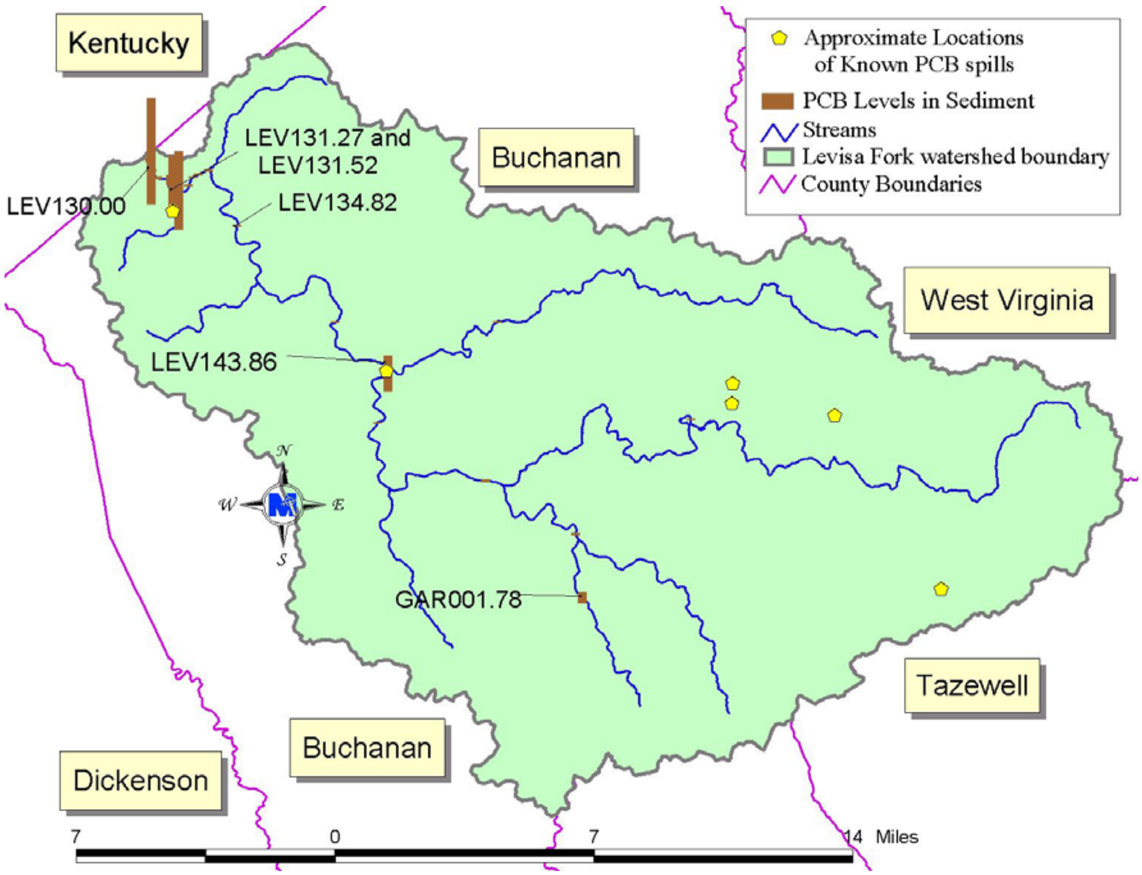

Figure 13.4 The locations and average concentrations of tPCBs in sediment samples in the Levisa Fork watershed.

The general PCB data trends discussed here show hot spots of higher PCB concentrations along Levisa Fork and its tributaries. Without a more intensive study of all potential sources/sites, the known contaminated sites, and streambed sediments of tributaries, it is difficult to pinpoint where all PCBs sources in this watershed are located. This chapter has provided a discussion of where potential sources may be by observing the data currently available. Possible unreported areas that are contaminated with tPCBs could be illegal dumps of leaking tPCB containing items, current mining operations with leaking equipment or transformers, abandoned mine lands, deep mines used as dump sites for non-useable equipment, or contaminated soil from old spills.

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14. TOTAL PCBS (tPCBs) MODELING PROCEDURE AND ALLOCATION

14.1 Model Selection, Model Setup, and Hydrology Modeling

HSPF was used as the modeling framework for the PCB modeling. The modeling framework selection, model setup of rainfall data, subwatershed, land uses, stream characteristics and hydrology modeling were the same for the PCB HSPF model as the bacteria HSPF model. These are explained in Section 4.1, 4.2, and 4.4 of this report. All The HSPF hydrology modeling components of the PCB model were the same as the hydrology components of the bacteria model.

The PCB data that were available for model calibration were collected during the 2008 water year. Due to this constraint, modeling was restricted to this time period to maintain confidence in the modeled output. This data limitation is one of the reasons that this TMDL has been submitted as a "Phase I" of a phased TMDL. While the time frame for modeling was limited, it did include both baseflow conditions and storm events, which are considered to be the two hydrologically critical conditions for NPS pollutant delivery and impact.

14.2 PCB transport

Polychlorinated bi-phenyls (PCBs) are hydrophobic compounds that tend to attach to organic matter, fatty tissue or become dissolved in an organic solvent rather than dissolve in water. These compounds are much more likely to be found in streambed sediments and in fish tissues within a contaminated channel. For this reason, total suspended sediment (TSS) was modeled as the vehicle on which PCBs travel from the land to surface waters, become suspended in the water column, and settle out in streambed sediments. TSS concentrations were calibrated, and then PCBs were attached to the TSS in order to model total PCB concentrations in the stream. This modeling was done using HSPF. The model is explained in more detail in Chapter 4.

14.2.1 Known and Unknown PCB Spill Sites

Of the six sites in the Levisa Fork watershed that either have PCB containing found and documented or have documented PCB spills, none have enough data collected to model the site specifically.

14.2.2 Permitted PCB point sources

For existing conditions, permitted point sources that deliver water and PCBs to the streams were modeled using known flow discharges from DEQ data and an average PCB concentration from sampling efforts (Table 13.1). For mining land uses, the average of all sampling was used as the inflow and groundwater concentrations (92 pg/L).

14.2.3 TSS calibration

There are no set criteria for water quality calibration set forth for a TMDL. Water quality observations are sparse with different amounts of data per stream. This makes it difficult to set standard criteria that must be met for all streams with different number of observations at different times during the day. Water quality calibration acceptance is evaluated based on three separate evaluations of the differences between observed and modeled TSS concentrations. The evaluations include: observed versus modeled TSS concentration graphs, maximum, and percentage greater than 30mg/L as a screening value.

Water quality calibration is complicated by a number of factors. First, water quality (TSS) concentrations are highly dependent on flow conditions. Any variability associated with the modeling of stream flow compounds the variability in modeling water quality parameters. Second, the concentration of TSS is variable by sampling location in the stream and grab sampling, which lead to difficulty in measuring and modeling TSS concentrations.

The TSS calibration was conducted using data from 10/1/2000 to 9/30/2003. Ten parameters utilized for TSS model adjustment are shown in Table 14.1. All of these parameters were initially set at expected levels for the watershed conditions and adjusted within reasonable limits until an acceptable match between measured and modeled TSS concentrations was established (Table 14.2).

Table 14.1 Model parameters utilized for TSS calibration.

Parameter	Units	Description	Typical Range	Initial Parameter Estimate	Calibrated Parameter Value
DELTH	feet	Change in water elevation along reach	0 to any	30.0	26.25 – 472.44
LEN	miles	Length of reach	0.01 to any	1.0	0.50 – 27.70
TAUCS	lb/ft^2	critical shear stress for scour	1.0E-10 to any	0.03 – 0.3	0.03 – 0.50
KSER	complex	coefficient in the detached sediment wash-off equation	0 to any	0.6252 – 0.7288	0.3126 – 0.7288
EXPSAND	complex	exponent in the sand-load power function formula	0 to any	2.0	1.5
KEIM	complex	coefficient in the solids wash-off equation	0 to any	0.03	0.01 - 0.03
NVSI	lb/ac/day	sediment from atmospheric detached storage	any	1.0	0.1
ACCSDP	tons/(ac* day)	rate solids accumulate on land	0 to any	0.01	0.1 – 0.4
REMSDP	1/day	fraction of solids storage removed when there is no runoff, i.e. street sweeping	0 to 1	0.01	0.3 – 0.6
AFFIX	1/day	sediment storage decrease from soil compaction	0 to 1	0.05	0.03 - 0.05

The range of modeled daily average values reaches the instantaneous monitored values. Monitored values are an instantaneous snapshot of TSS concentration, whereas the modeled values are daily averages based on hourly modeling. The monitored values may have been sampled at a high flow at the highest concentration of the day and thus correctly appear above the modeled daily average. The final calibrated TSS values are shown in Figures 14.1 through 14.6. These figures are presented from upstream to downstream.

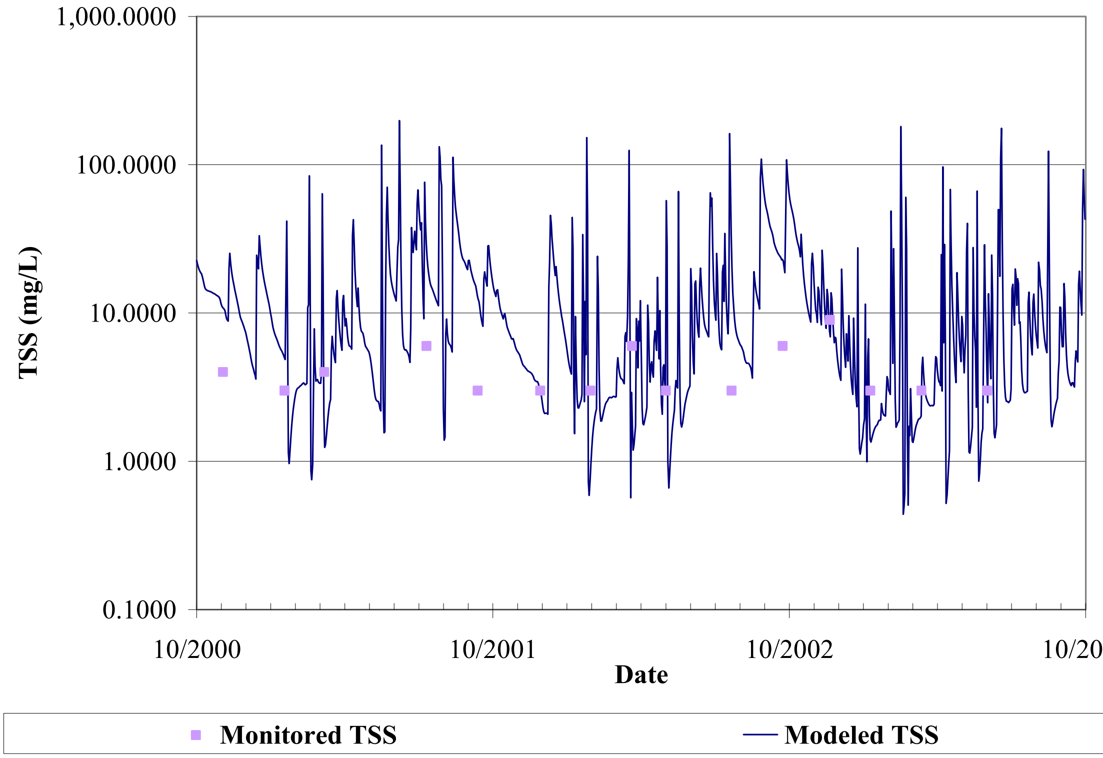

Figure 14.1 TSS calibration results at VADEQ station 6AGAR000.16 in subwatershed 12 in the Garden Creek impairment.

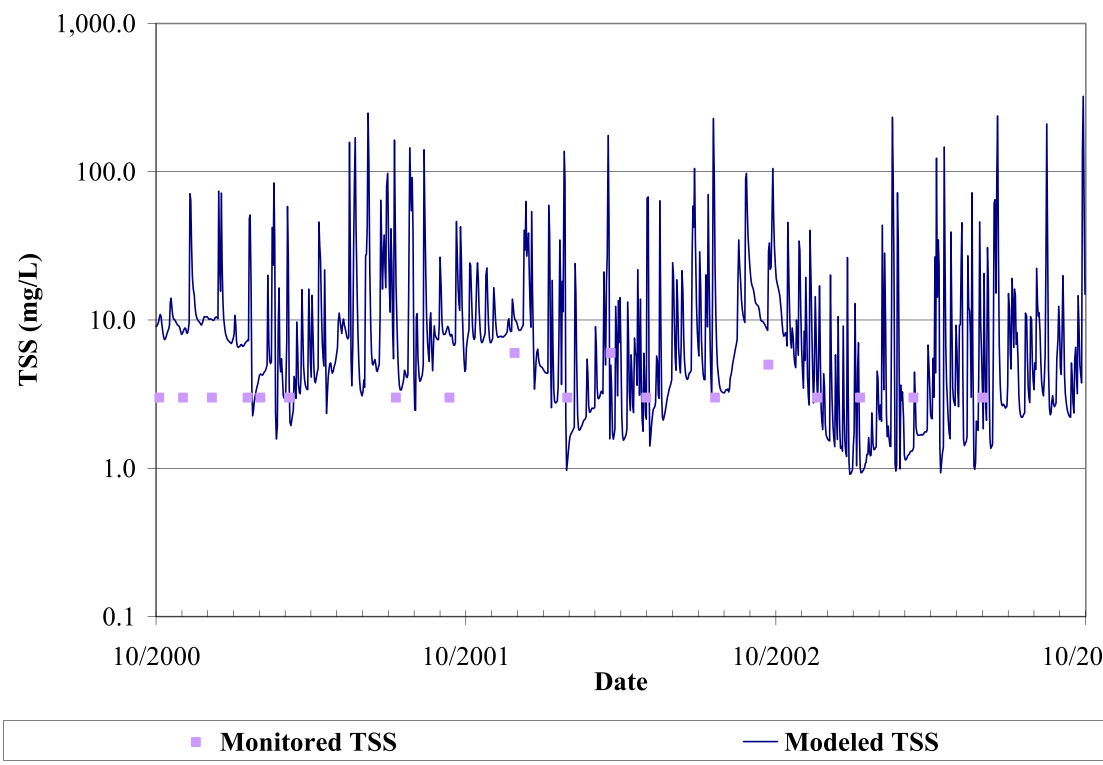

Figure 14.2 TSS calibration results at VADEQ station 6ALEV152.46 at the outlet of subwatershed 12 in the Levisa Fork impairment.

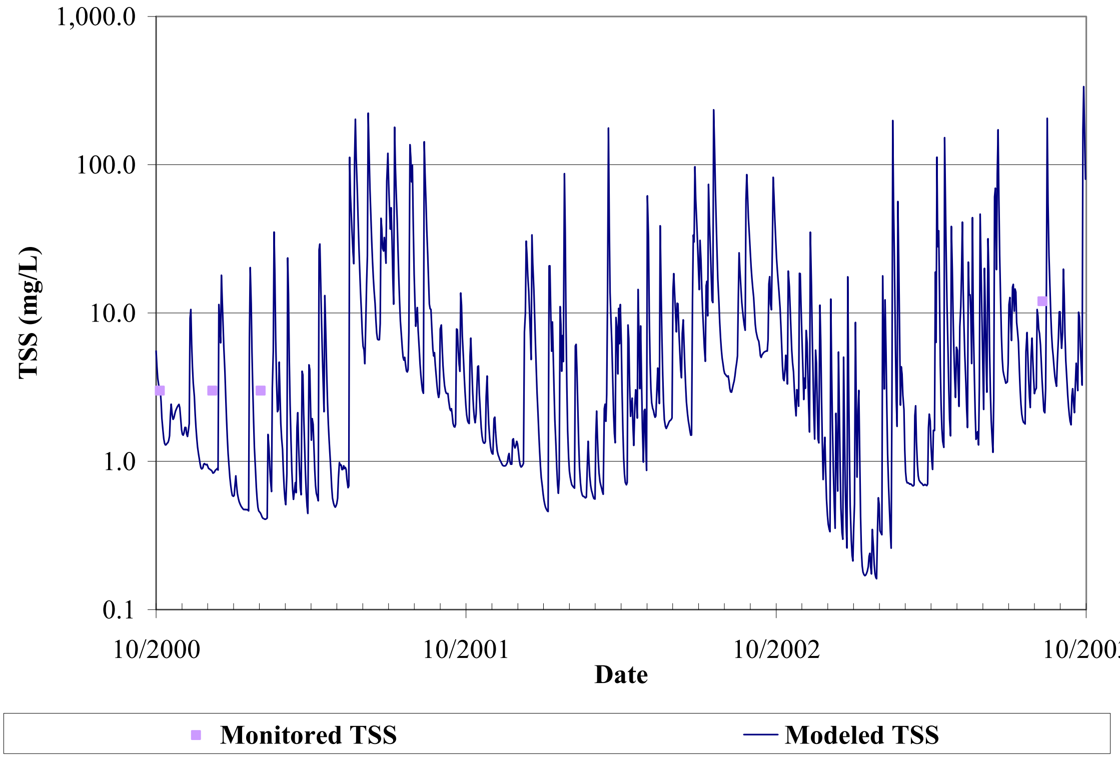

Figure 14.3 TSS calibration results at VADEQ station 6ADIS001.24 at the outlet of subwatershed 11 in Dismal Creek.

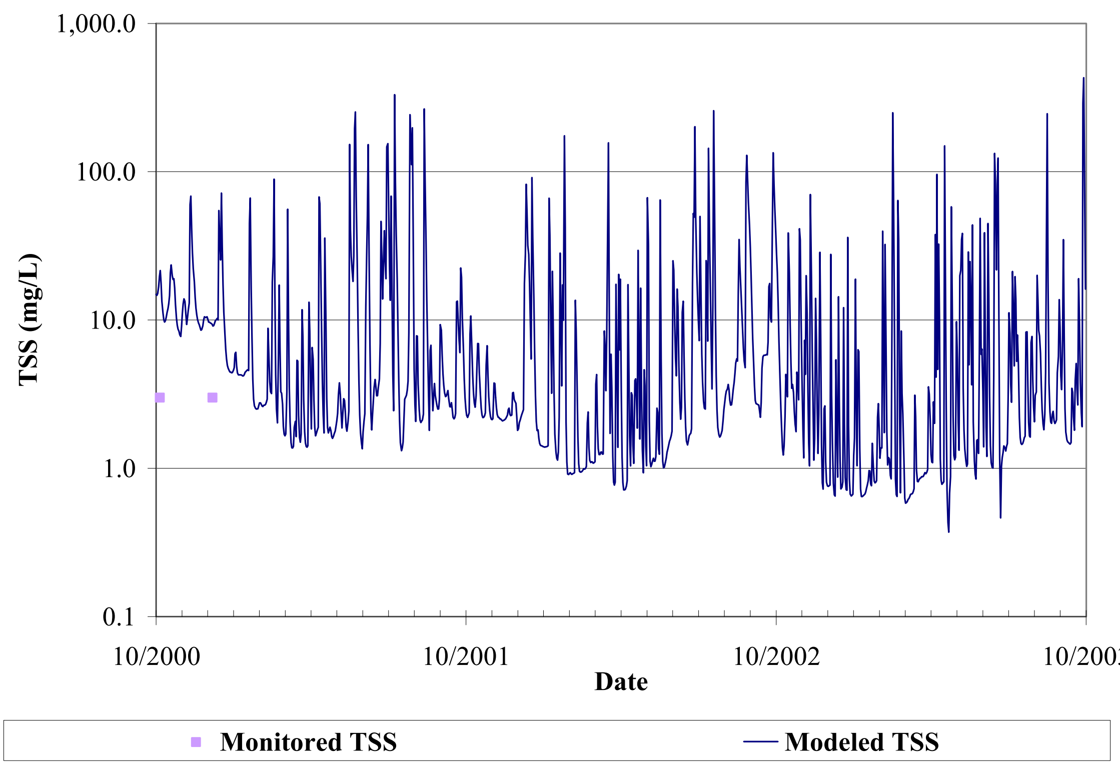

Figure 14.4 TSS calibration results at VADEQ station 6ASAT000.03 at the outlet of subwatershed 10 in Slate Creek.

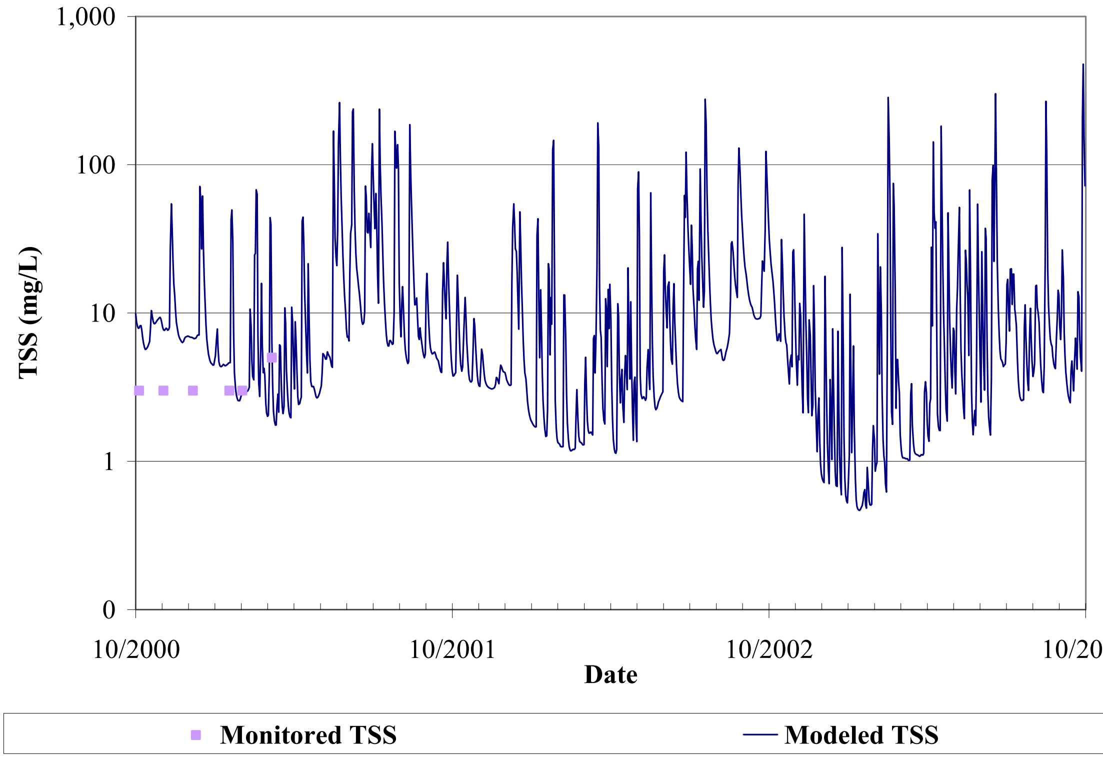

Figure 14.5 TSS calibration results at VADEQ station 6ALEV143.86 at the outlet of subwatershed 5 in the Levisa Fork impairment.

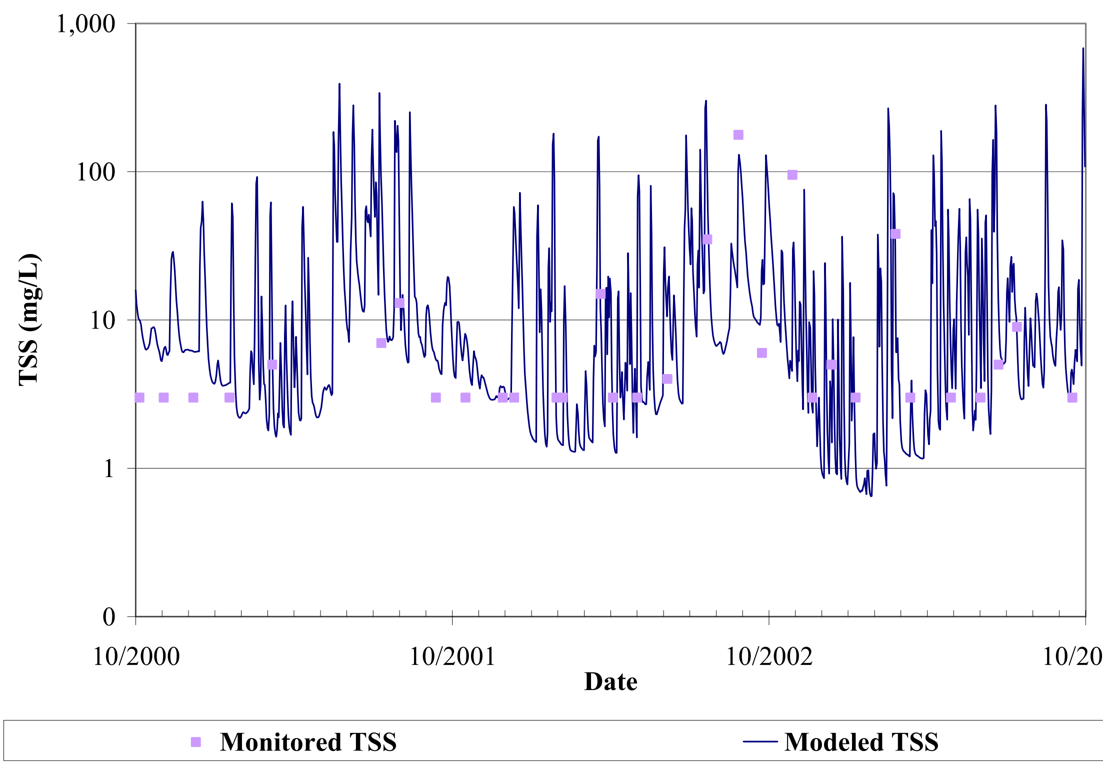

Figure 14.6 TSS calibration results at VADEQ station 6ALEV131.52 at the outlet of subwatershed 8 in the Levisa Fork impairment.

Table 14.2 shows the modeled and observed maximum values and the percentage higher than a 30mg/L TSS screening value. The differences between modeled and monitored values are within one standard deviation of the observed data at each station. The graphs above and the table below show that the results of the TSS calibration are acceptable.

Table 14.2 Comparison of modeled and observed TSS calibration results for the Levisa Fork watershed.

Stream	DEQ Station	Subwatershed	Modeled TSS 10/1/00 to 9/30/03			Monitored TSS 10/1/00 to 9/30/03		
			n	Maximum (mg/L)	% > 30 mg/L[1]	*n*	Maximum (mg/L)	% > 30 mg/L[1]
Garden Creek	GAR000.16	12	1095	198.45	9.68%	16	9.00	0.00%
Levisa Fork	LEV152.46	3	1095	321.82	8.86%	18	6.00	0.00%
Dismal Creek	DIS001.24	11	1095	336.81	8.31%	4	12.00	0.00%
Slate Creek	SAT000.03	10	1095	430.33	9.68%	2	3.00	0.00%
Levisa Fork	LEV143.86	5	1095	472.32	11.78%	6	5.00	0.00%
Levisa Fork	LEV131.52	8	1095	682.19	14.70%	31	177.0	12.90%

[1] 30mg/L is the TSS screening value

14.2.4 tPCB water column calibration

There are no set criteria for water quality calibration set forth for a TMDL. Water quality observations are sparse with different amounts of data per stream. This makes it difficult to set standard criteria that must be met for all streams with different number of observations at different times during the day. Water quality calibration acceptance is evaluated based on three separate evaluations of the differences between observed and modeled PCB concentrations. The evaluations include: observed versus modeled PCB concentration graphs, maximum, and percentage greater than 640 pg/L as the PCB endpoint.

Water quality calibration is complicated by a number of factors. First, water quality (PCB) concentrations are highly dependent on flow conditions and on sediment transport throughout the system. Any variability associated with the modeling of stream flow and

TSS compounds the variability in modeling water quality parameters. Second, the concentration of PCB is variable by sampling location in the stream and composite sampling, which lead to difficulty in measuring and modeling PCB concentrations.

The PCB calibration was conducted from 9/1/2007 to 9/30/2008. Seven parameters utilized for PCB model adjustment are shown in Table 14.3. All of these parameters were initially set at expected levels for the watershed conditions and adjusted until an acceptable match between measured and modeled PCB concentrations was established (Table 4.4).

Table 14.3 Model parameters utilized for TSS calibration.

Parameter	Units	Description	Possible Range	Initial Parameter Estimate	Calibrated Parameter Value
POTFW	pg/ton	Washoff potency factor	0 - any	0	0 – 6.32E09
POTFS	pg/ton	Scour potency factor	0 – any	0	0 – 6.32E09
IOQC	pg/ft^3	Interflow concentration	0 – any	0	0 – 2.80E7
AOQC	pg/ft^3	Groundwater concentration	0 - any	0	0 – 2.83E7
GQ-KD	L/mg	Adsorption coefficients of qual	1.0E-10 - any	0.0001 – 1.0	0.1 – 1.0
GQ-ADRATE	1/day	Adsorption/desorption rate	0.00001 - any	0.0001 – 25.0	0.000065 - 0.00026
GQ-SEDCONC	pg/mg	Initial concentrations on sediment	0 - any	0	1.05 – 19.26

The range of modeled daily average values reaches the instantaneous monitored values. Monitored values are an instantaneous snapshot of PCB concentration, whereas the modeled values are daily averages based on hourly modeling. The monitored values may have been sampled at a high flow at the highest concentration of the day and thus correctly appear above the modeled daily average. The final calibrated PCB values are shown in Figures 4.7 through 4.12. These figures are presented from upstream to downstream.

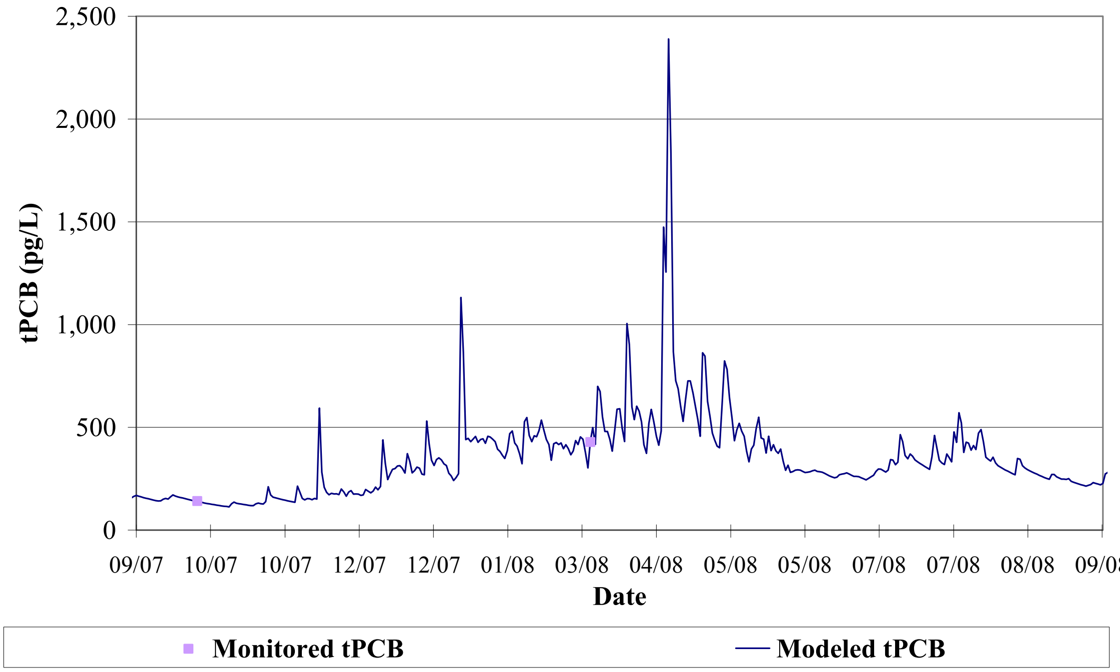

Figure 14.7 PCB calibration results at VADEQ station 6ALEV156.82 in subwatershed 2 in the Levisa Fork impairment.

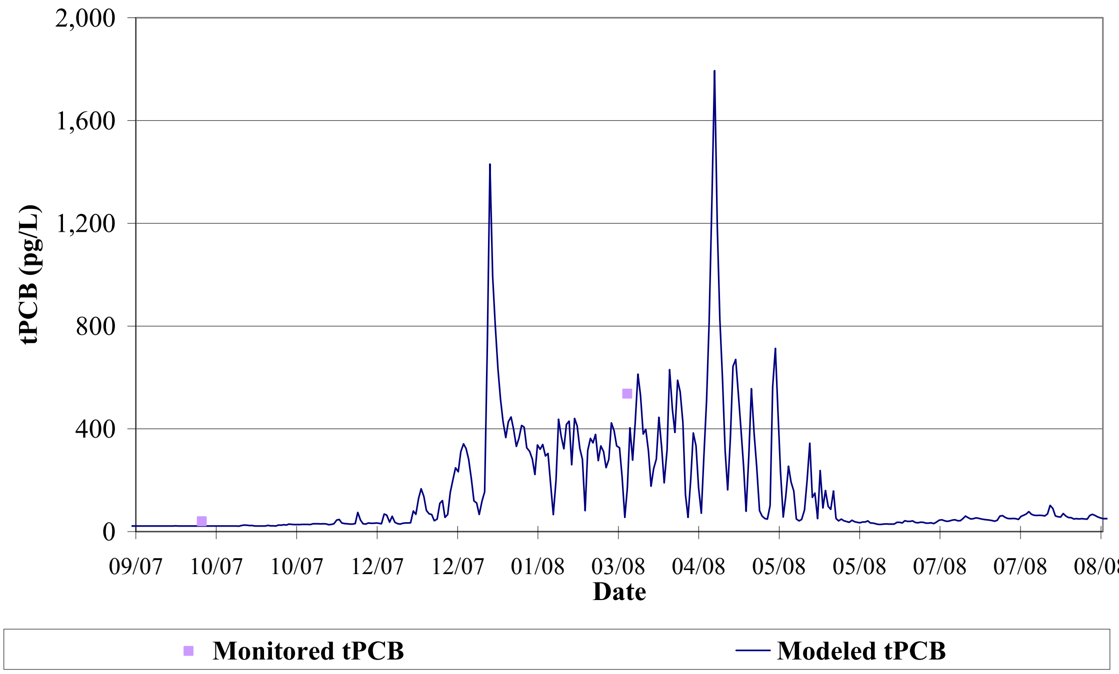

Figure 14.8 PCB calibration results at VADEQ station 6AGAR000.16 in subwatershed 12 in the Garden Creek impairment.

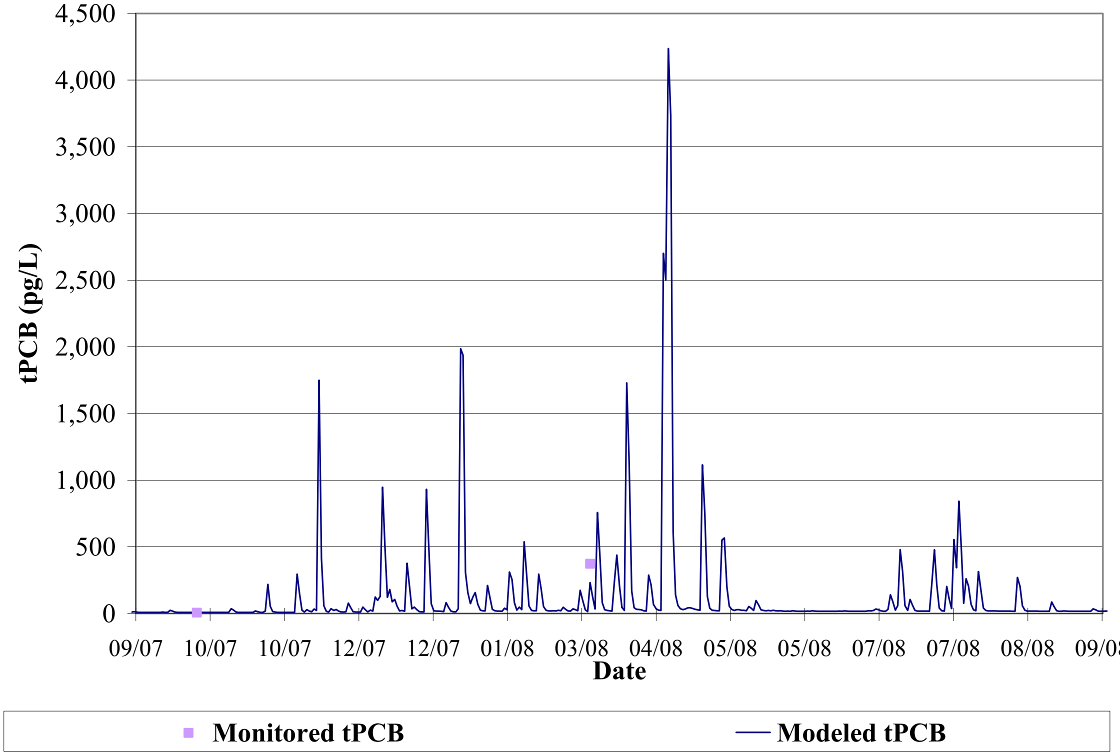

Figure 14.9 PCB calibration results at VADEQ station 6ALEV152.46 in subwatershed 3 in the Levisa Fork impairment.

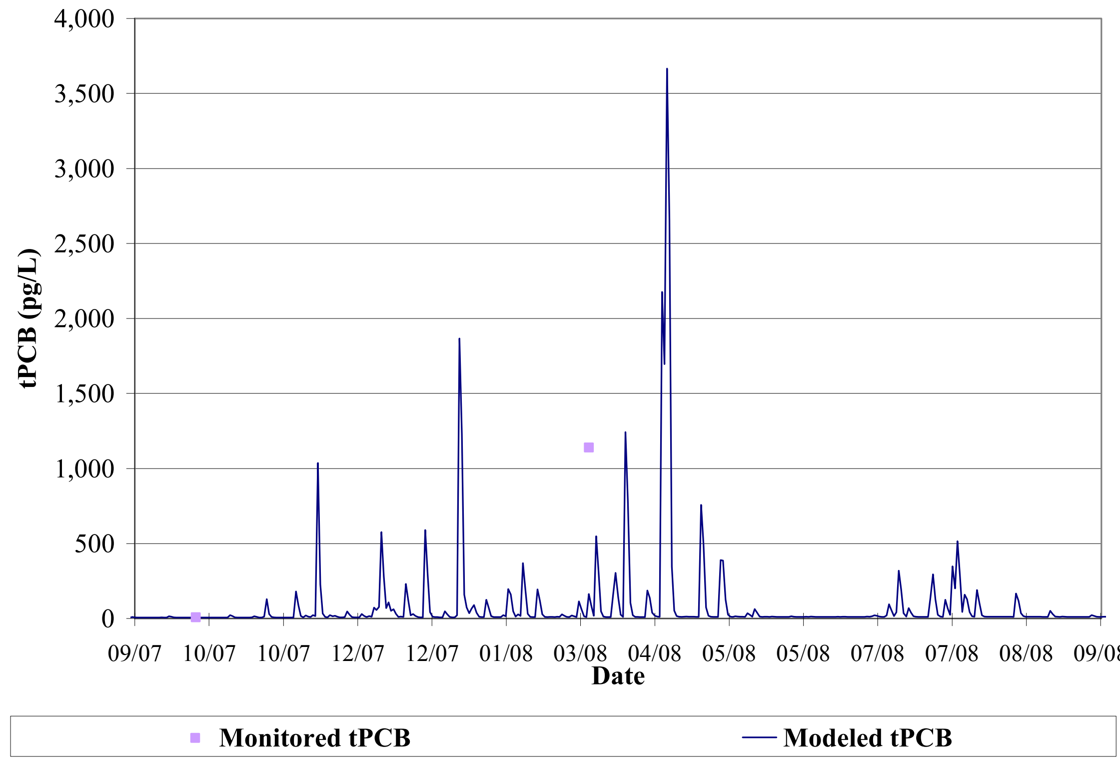

Figure 14.10 PCB calibration results at VADEQ station 6ADIS001.24 in subwatershed 11 in Dismal Creek.

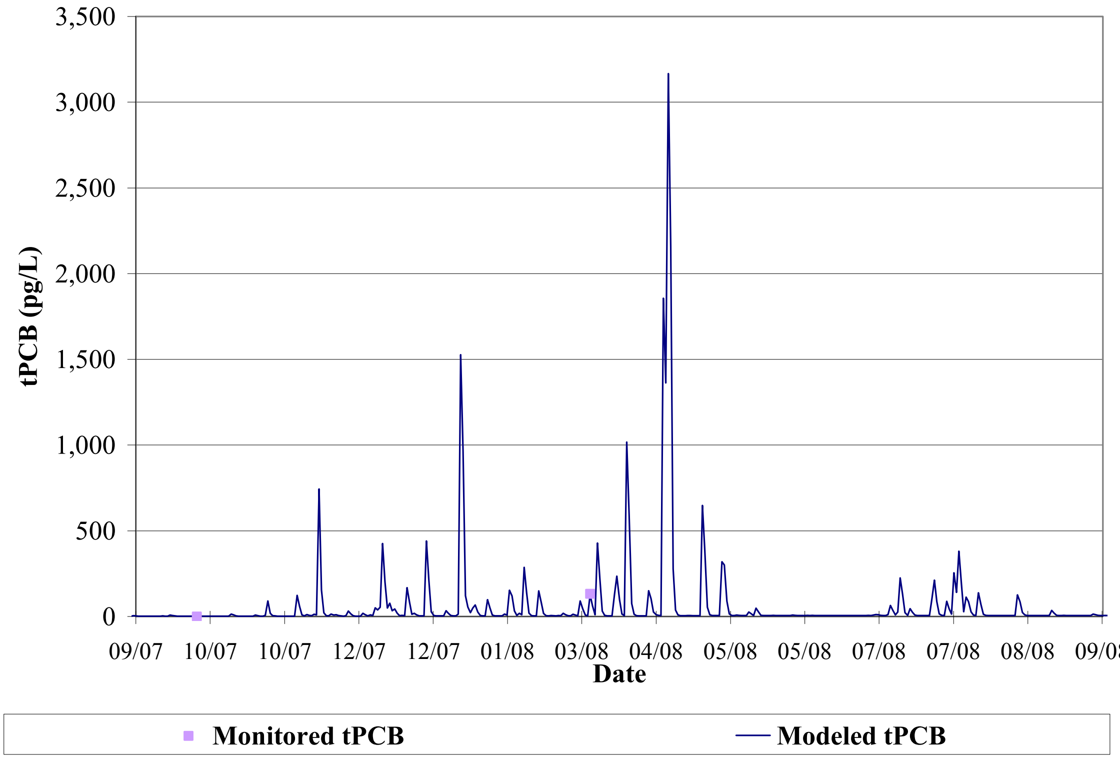

Figure 14.11 PCB calibration results at VADEQ station 6ABIP000.18 in subwatershed 13 in Big Prater Creek.

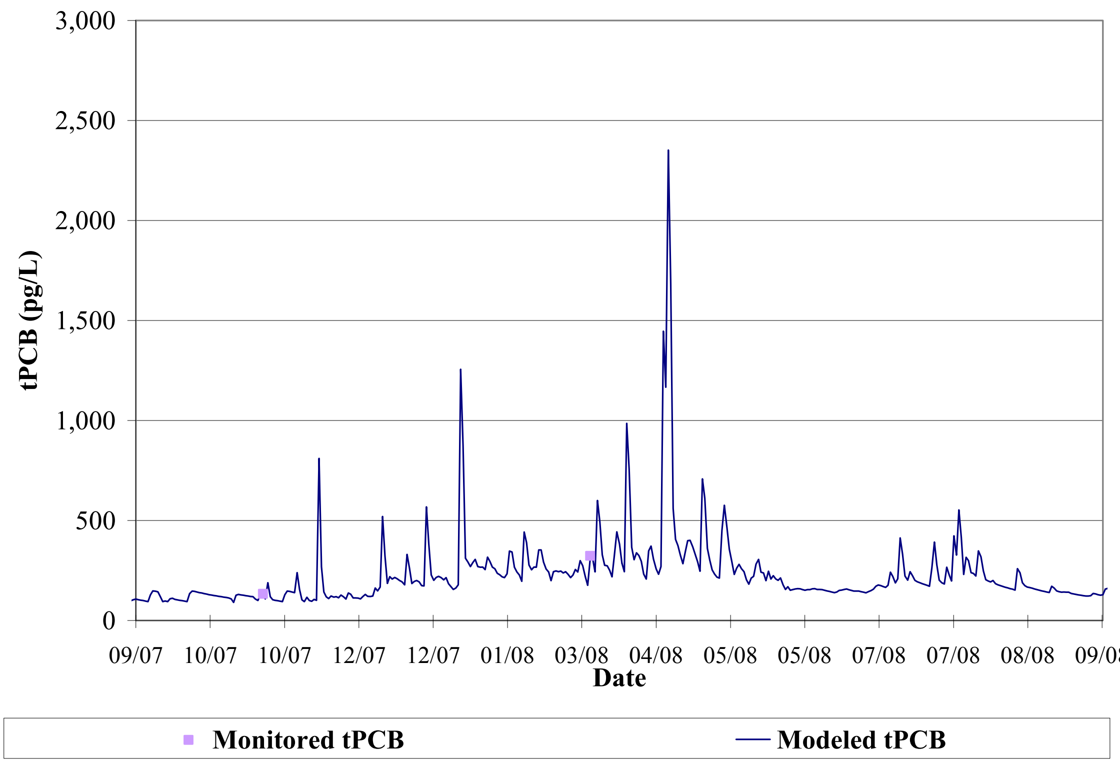

Figure 14.12 PCB calibration results at VADEQ station 6ASAT000.26 in subwatershed 10 in Slate Creek.

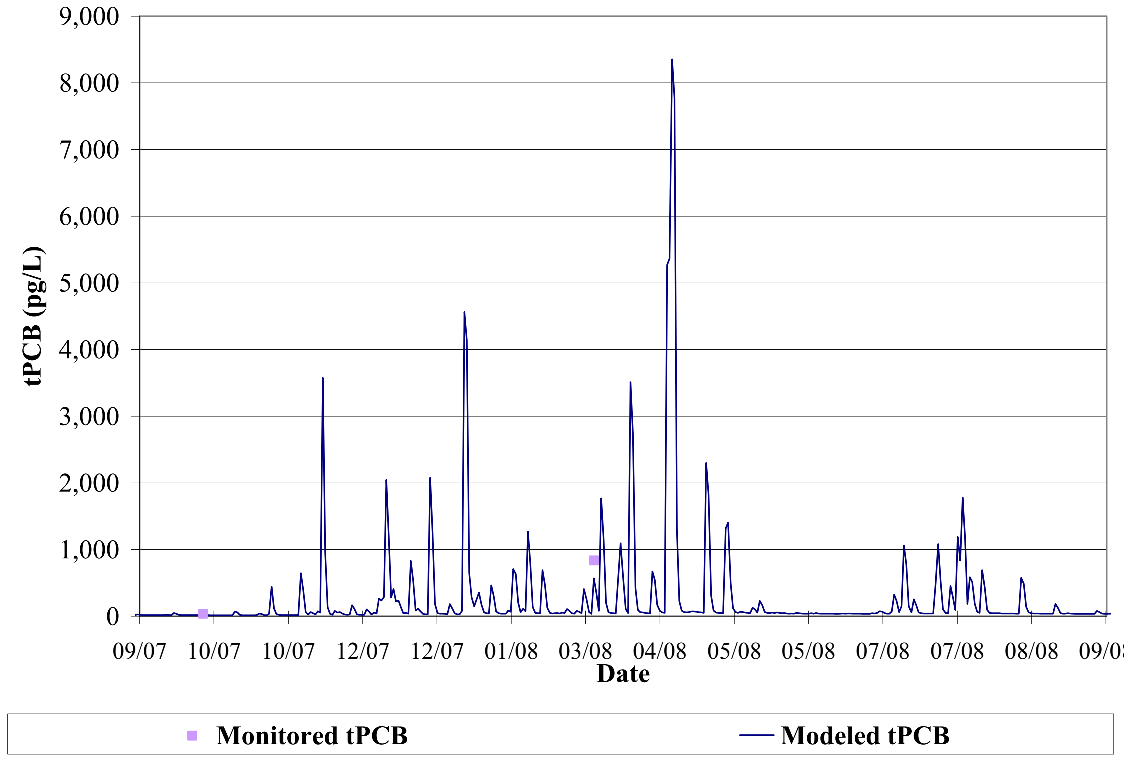

Figure 14.13 PCB calibration results at VADEQ station 6ALEV143.80 in subwatershed 5 in the Levisa Creek impairment.

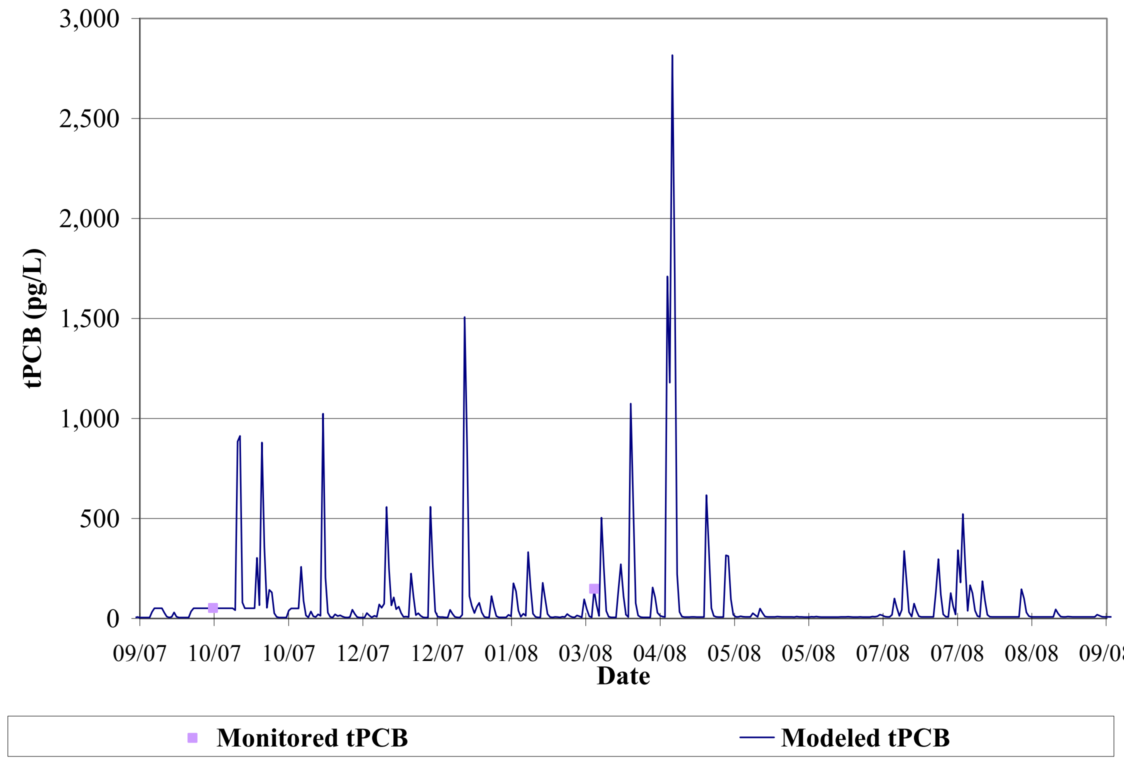

Figure 14.14 PCB calibration results at VADEQ station 6ABLC002.30 in subwatershed 14 in Bull Creek.

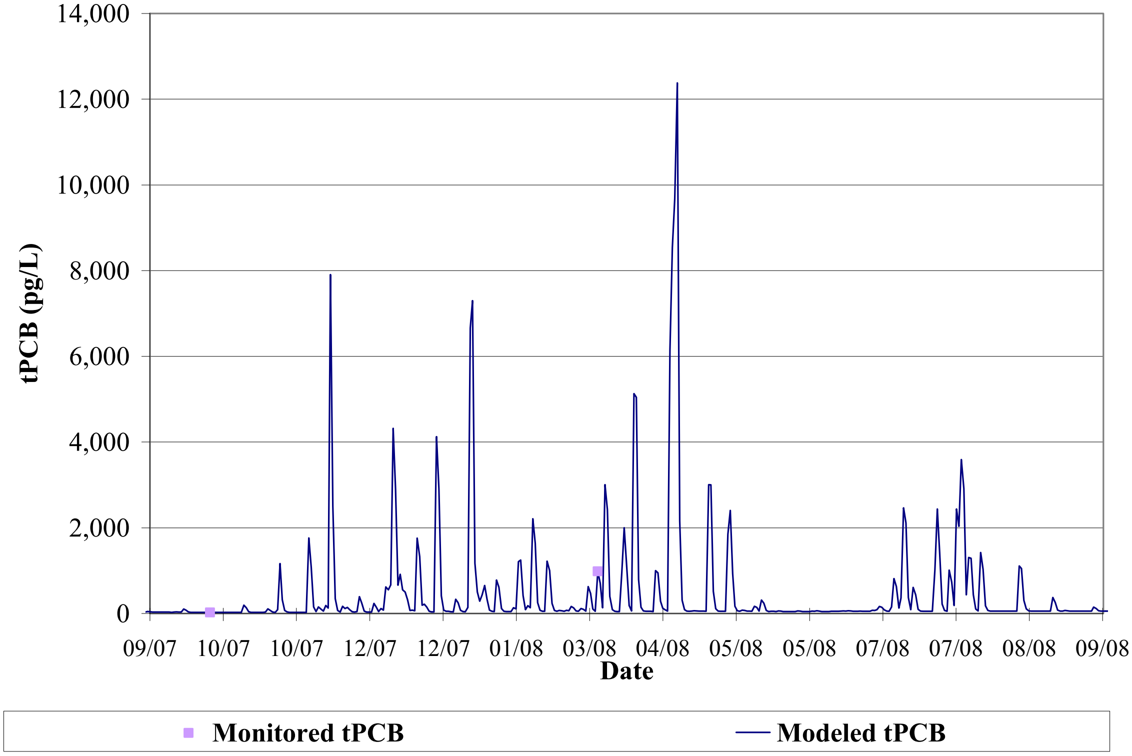

Figure 14.15 PCB calibration results at VADEQ station 6ALEV131.52 in subwatershed 8 in the Levisa Creek impairment.

Table 14.4 shows the modeled and observed maximum values and the percentage higher than the 640 pg/L PCB endpoint. The graphs above and the table below show that the results of the PCB calibration are acceptable.

Existing conditions for this project would be 2009, however, no other PCB water column or source data is available. Therefore, the 9/1/07 to 9/30/08 calibration modeling time period is as close to existing conditions as possible.

Table 14.4 Comparison of modeled and observed PCB calibration results for the Levisa Fork watershed.

			Modeled PCB 9/1/07 to 9/30/08			Monitored PCB 9/1/07 to 9/30/08		
Stream	DEQ Station	Subwatershed	*n*	Maximum (pg/L)	% > 640 pg/L[1]	*n*	Maximum (pg/L)	% > 640 pg/L[1]
Levisa Fork	LEV156.82	2	396	2,390	5.30%	2	428	0.00%
Garden Creek	GAR000.16	12	396	1,794	3.03%	2	537	0.00%
Levisa Fork	LEV152.46	3	396	4,237	3.79%	2	372	0.00%
Dismal Creek	DIS001.24	11	396	3,666	2.53%	2	1,140	50.00%
Big Prater Creek	BIP000.18	13	396	3,167	2.27%	2	132	0.00%
Slate Creek	SAT000.03	10	396	2,352	2.53%	2	323	0.00%
Levisa Fork	LEV143.86	5	396	8,354	9.60%	2	836	50.00%
Bull Creek	BLC002.30	14	396	2,816	2.78%	2	148	0.00%
Levisa Fork	LEV131.52	8	396	12,377	16.41%	2	986	50.00%

[1] 640pg/L is the PCB endpoint

14.3 Margin of Safety

In order to account for uncertainty in modeled output, a Margin of Safety (MOS) was incorporated into the TMDL development process. Individual errors in model inputs, such as data used for developing model parameters or data used for calibration, may affect the load allocations in a positive or a negative way. A MOS can be incorporated implicitly in the model through the use of conservative estimates of model parameters, or explicitly as an additional load reduction requirement. The intention of an MOS in the development of this PCB TMDL is to ensure that the modeled loads do not underestimate the actual loadings that exist in the watershed. An explicit load of 5% of the final TMDL was used as the MOS for the PCB TMDLs.

14.4 Wasteload Allocations

The PCB existing condition load from the mining land uses was calculated using the average sampled PCB concentration (92 pg/L) and the flow from the model. The PCB allocated load (WLA) from the mining land uses was calculated using the endpoint PCB concentration (640 pg/L) and the flow from the model Therefore, the WLAs for the

DMME surface mining permits were calculated as the average daily flow from the mining land uses multiplied by the endpoint and area-weighted to get the PCB load from each DMME permit. All other permits (DEQ) were modeled at their design flow times the endpoint.

14.5 Load Allocations

Atmospheric deposition loads in the LA were calculated using the value of 1.6 $\mu g/m^2/yr$ (Section 13.2.1; CBP, 1999). This value was multiplied by the entire area of the Levisa Fork drainage area and convert to become mg/yr in Table 14.5. The same procedure was used to calculate a value for Garden Creek using its' drainage area.

All non-mining land use PCB sources were reduced until the streams met the PCB endpoint.

14.6 Garden Creek tPCB TMDL

Modeling was conducted for a target value of 0% exceedance of the PCB endpoint 640 pg/L. The final scenario for Garden Creek was an overall 62.1% reduction of the estimated existing tPCB load.

Figure 14.16 shows the existing and allocated PCB concentrations from the Garden Creek impairment outlet. This graph shows existing conditions in black, with allocated conditions overlaid in blue.

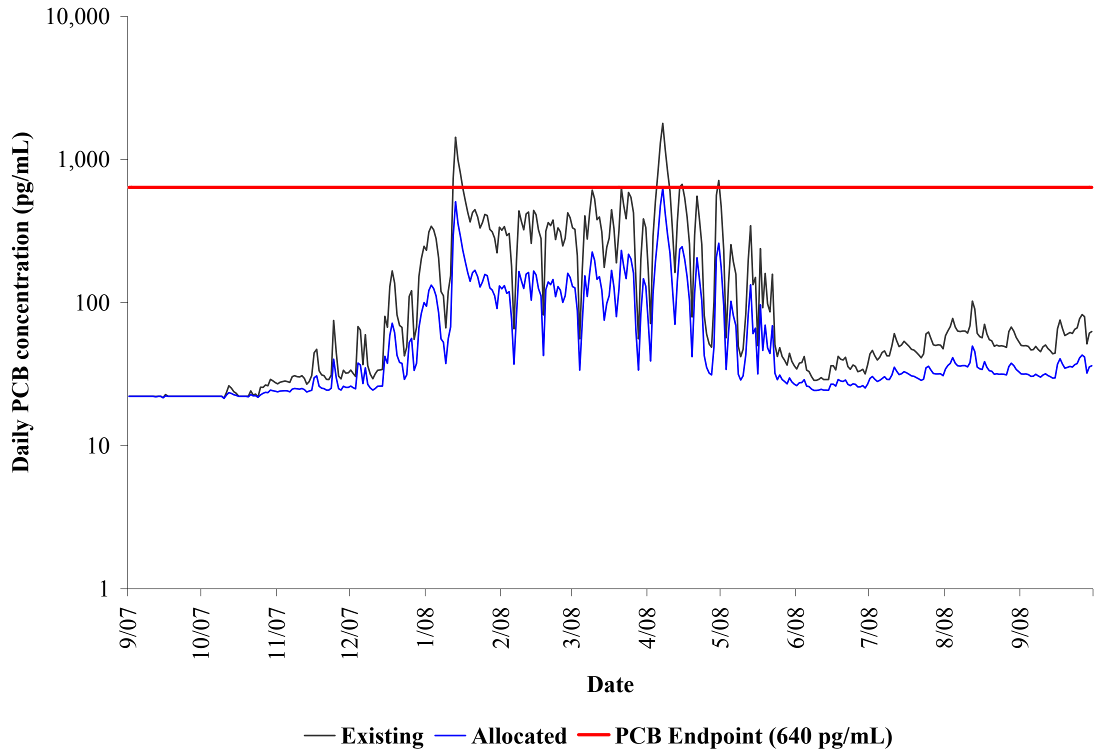

Figure 14.16 Existing and allocated monthly geometric mean in-stream PCB concentrations in subwatershed 12, Garden Creek impairment outlet.

Table 14.5 shows the average annual TMDL, which gives the average load of PCBs that can be present in the stream in a given year, and still meet the endpoint.

Table 14.5 Final average annual in-stream PCB loads (mg/year) modeled after TMDL allocation in the Garden Creek impairment.

Source	WLA (mg/yr)	LA (mg/yr)	MOS (mg/yr)	TMDL (mg/yr)	Existing (mg/yr)	% Reductions Needed
DMME permits:						
1201698	*0.57*				*0.08*	0%
1400047	*225.02*				*32.35*	0%
1400492	*1.07*				*0.15*	0%
1400493	*4.18*				*0.60*	0%
1401489	*0.48*				*0.07*	0%
1401531	*41.43*				*5.96*	0%
1500384	*23.07*				*3.32*	0%
1700864	*23.28*				*3.35*	0%
DMME permits total	**319.10**				**45.87**	0%
Nonpoint Source Land Loads[1]		**632.36**			**2597.81**	75.66%
Atmospheric Deposition		**0.25**			**0.25**	0%
MOS			**50.09**			0%
Total	**319.10**	**632.61**	**50.09**	**1001.80**	**2643.93**	62.11%

[1] includes the known contaminated sites and all other non-mining land uses

Starting in 2007, the USEPA has mandated that TMDL studies include a daily load as well as the average annual load previously shown. The approach to developing a daily maximum load was similar to the USEPA approved approach to developing load duration TMDLs. The daily average in-stream PCB loads for Garden Creek are shown in Table 14.6. The daily TMDL and WLAs were calculated as the annual value divided by 365. The LA is the difference between the TMDL and the WLA. This calculation of the daily TMDL does not account for varying stream flow conditions.

Table 14.6 Final average daily in-stream PCB loads (mg/day) modeled after TMDL allocation in the Garden Creek impairment.

Source	WLA (mg/day)	LA (mg/day)	MOS (mg/ day)	TMDL (mg/ day)
DMME permits:				
1201698	*0.002*			
1400047	*0.62*			
1400492	*0.003*			
1400493	*0.01*			
1401489	*0.001*			
1401531	*0.11*			
1500384	*0.06*			
1700864	*0.06*			
DMME permits total	**0.87**			
Nonpoint Source Land Loads[1]		**1.73**		
Atmospheric Deposition		**0.001**		
MOS			**0.14**	
Total	**0.87**	**1.73**	**0.14**	**2.74**

[1] includes the known contaminated sites and all other non-mining land uses

14.7 Levisa Fork tPCB TMDL

Modeling was conducted for a target value of 0% exceedance of the PCB endpoint 640 pg/L. The final scenario for Levisa Fork was an overall 94.5% reduction of the estimated existing tPCB load.

Figure 14.17 shows the existing and allocated PCB concentrations from the Garden Creek impairment outlet. This graph shows existing conditions in black, with allocated conditions overlaid in blue.

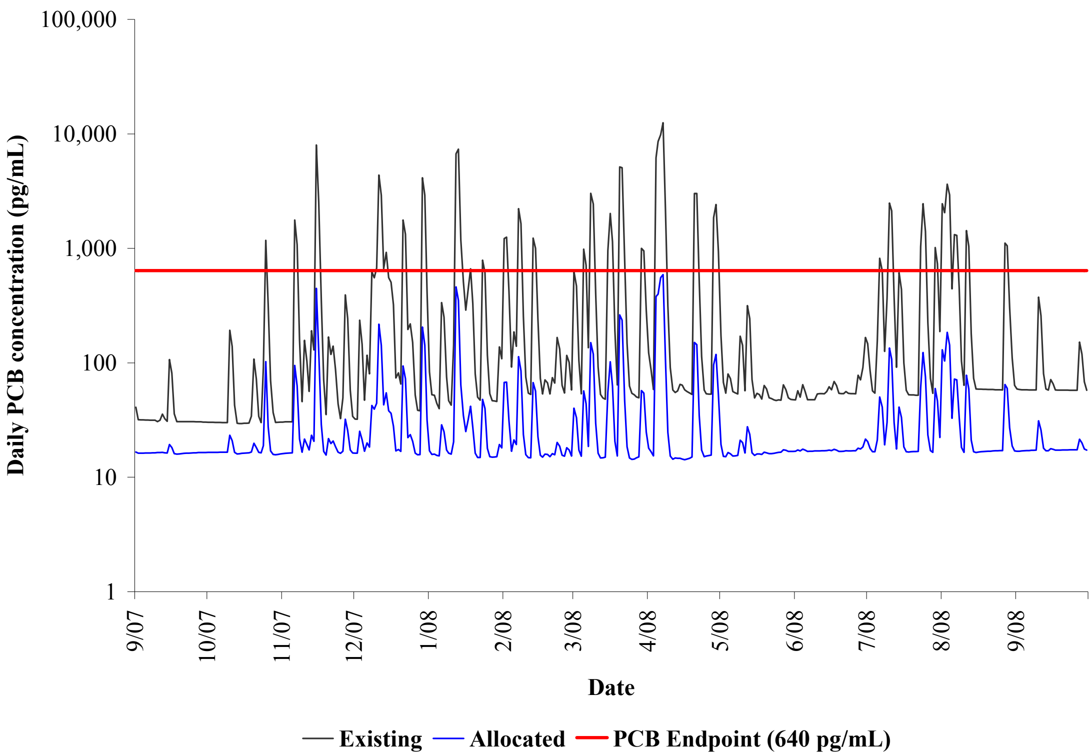

Figure 14.17 Existing and allocated monthly geometric mean in-stream PCB concentrations in subwatershed 8, Levisa Fork impairment outlet.

Table 14.7 shows the average annual TMDL, which gives the average load of PCBs that can be present in the stream in a given year, and still meet the endpoint. The Levisa Fork TMDL includes all reductions needed in the Garden Creek TMDL.

Table 14.7 Final average annual in-stream PCB loads (mg/year) modeled after TMDL allocation in the Levisa Fork impairment.

Source	WLA (mg/yr)	LA (mg/yr)	MOS (mg/yr)	TMDL (mg/yr)	Existing (mg/yr)	% Reductions Needed
VPDES permits:						
VA0090531	*1,769.76*				*4,489.85*	60.58%
VA0050351	*176.98*				*55.37*	0%
VA0052639	*0.88*				*61.43*	98.56%
VPDES permits total	**1,947.62**				**4,606.65**	57.7%
DMME permits total[1]	**3,061.68**				**440.12**	0%
Nonpoint Source Land Loads[2]		**3,419.73**			**156,665.28**	97.82%
Atmospheric Deposition		**1.39**			**1.39**	0%
MOS			**443.71**			0%
Total	**5,009.30**	**3,421.12**	**443.71**	**8,874.14**	**161,713.44**	94.51%

[1] DMME permits are shown individually in Table 14.8
[2] includes the known contaminated sites and all other non-mining land uses

Table 14.8 shows each DMME mining permits' estimated existing and allocated PCB load.

Table 14.8 Existing and allocated annual PCB loads for DMME mining permits within the Levisa Fork watershed.

DMME Permit	Existing mg/yr	Allocated mg/yr	DMME Permit	Existing mg/yr	Allocated mg/yr	DMME Permit	Existing mg/yr	Allocated mg/yr
1100470	3.26	22.70	1201348	2.72	18.93	1301640	2.86	19.90
1101381	16.04	111.55	1201373	0.09	0.66	1400047	67.40	468.85
1101553	9.45	65.72	1201442	0.18	1.24	1400345	3.73	25.95
1101701	2.37	16.46	1201484	1.55	10.78	1400419	0.81	5.61
1101736	6.06	42.14	1201495	0.38	2.65	1400492	13.88	96.54
1101752	21.20	147.50	1201508	0.46	3.21	1400493	7.03	48.92
1101792	8.21	57.08	1201523	0.27	1.85	1400496	7.68	53.42
1101823	17.94	124.77	1201532	0.12	0.85	1400498	4.64	32.29
1101846	6.63	46.15	1201539	0.25	1.72	1401039	1.16	8.09
1101881	0.30	2.08	1201540	0.51	3.56	1401167	2.22	15.43
1101903	17.08	118.84	1201574	0.84	5.81	1401181	0.59	4.10
1101979	3.19	22.20	1201678	0.13	0.91	1401232	4.34	30.17
1101987	4.89	33.98	1201698	0.12	0.85	1401489	8.22	57.21
1101999	1.21	8.42	1201716	0.82	5.70	1401493	1.22	8.51
1102001	14.95	104.02	1201749	0.50	3.48	1401531	8.89	61.86
1102030	8.07	56.17	1201753	4.76	33.10	1401598	3.96	27.53
1200194	1.43	9.92	1201902	0.67	4.66	1401635	3.12	21.70
1200235	0.88	6.10	1201906	0.07	0.47	1401645	0.16	1.11
1200281	0.30	2.09	1201907	0.17	1.19	1500384	4.95	34.45
1200282	0.21	1.43	1201922	0.46	3.18	1601787	16.43	114.31
1200308	2.21	15.34	1201940	0.28	1.97	1601788	15.90	110.64
1200335	0.56	3.90	1201988	0.21	1.47	1601816	10.77	74.95
1200342	0.27	1.85	1202036	0.37	2.56	1700864	5.00	34.77
1200343	0.27	1.87	1300120	1.07	7.48	1701300	5.13	35.66
1200354	2.11	14.70	1300359	5.00	34.79	1801821	0.00	0.01
1200881	0.24	1.67	1300378	0.65	4.51			
1201015	0.64	4.45	1300379	2.93	20.35			
1201050	0.61	4.22	1300398	1.29	8.99			
1201053	0.15	1.01	1300404	0.97	6.77			
1201091	1.81	12.61	1300417	1.05	7.32			
1201097	0.10	0.72	1300425	9.58	66.65			
1201131	0.09	0.61	1300426	15.32	106.57			
1201182	1.31	9.12	1300451	1.52	10.58			
1201230	0.30	2.12	1300453	12.36	86.01			
1201273	0.82	5.71	1300454	2.15	14.94			
1201276	0.15	1.03	1300945	0.22	1.50			
1201310	0.16	1.14	1301156	1.02	7.08			
1201345	2.07	14.43	1301226	11.44	79.57			

Starting in 2007, the USEPA has mandated that TMDL studies include a daily load as well as the average annual load previously shown. The approach to developing a daily maximum load was similar to the USEPA approved approach to developing load duration TMDLs. The daily average in-stream PCB loads for Levisa Fork are shown in Table 14.9. The daily TMDL and WLAs were calculated as the annual value divided by 365. The LA is the difference between the TMDL and the WLA. This calculation of the daily TMDL does not account for varying stream flow conditions.

Table 14.9 Final average daily in-stream PCB loads (mg/day) modeled after TMDL allocation in the Levisa Fork impairment.

Source	WLA (mg/ day)	LA (mg/ day)	MOS (mg/ day)	TMDL (mg/ day)
VPDES permits:				
VA0090531	*4.85*			
VA0050351	*0.48*			
VA0052639	*0.002*			
VPDES permits total	**5.34**			
DMME permits total	**8.39**			
Nonpoint Source Land Loads[1]		**9.36**		
Atmospheric Deposition		**0.004**		
MOS			**1.22**	
Total	**13.72**	**9.36**	**1.22**	**24.31**

[1] includes the known contaminated sites and all other non-mining land uses